THE UNIVERSITY OF MICHIGAN
SEP 18 1959
FORESTRY

Forest Machinery and Royal Show Review

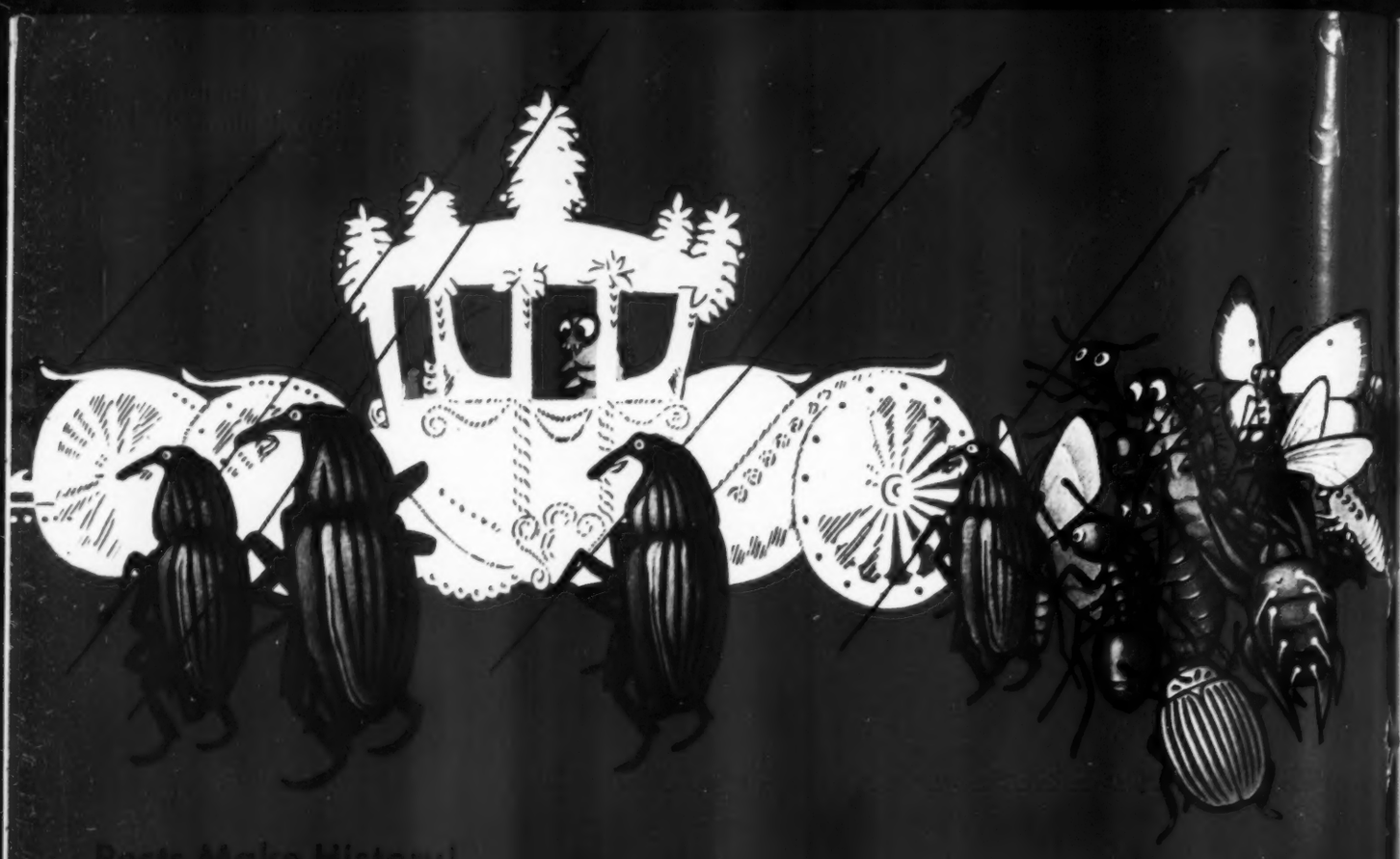
WORLD CROPS

The International Journal of Agriculture

VOLUME 11, No. 8 AUGUST 1959

A Publication of The Leonard Hill Technical Group

Clearing land for agriculture. Having grubbed out the tree a few shakes removes the earth from its roots before this International Skid Shovel carries it away



Pests Make History!

This is by no means an exaggerated statement especially when it is considered that for a large part man has been faced with the most difficult of problems brought about by the occurrence of tiny bugs, fungus, moths and disease germs that attack our crops. It was very soon realized that unless these pests were fought we would be in danger of losing the basic food and so vital for providing food for all nations. Combating pests has become the order of the day — total war must be waged employing all resources of our approach.

A single bug or one or two larvae are a harmless proposition and cannot inflict any appreciable damage. But the millions of ravenous insects colonizing and destroying crops all over the world, and which recognize neither frontiers nor territorial rights, are an entirely different proposition.

Alarming figures prove that the threat of pests can make history in the strictest sense of the term. In 1845, the potato crops in Ireland were completely destroyed by late blight; a third of the population died during the famine that followed, and 1½ million people emigrated to America.

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CONTENTS

Editorial Comment:
More Forest Research; Fertilisers and Forestry; Building for the Future; The Age of Miracles; G.P. and A.P.; Millions Go Hungry; Fertilisers for Export; Future of Small Farms; Effect of Farm Size; Difficulties of Small Farming; Small Farm Improvement; Apples, Vinegar and Toddy; The Beverage . . . and the Plant 267

Advance into the Arctic—*W. Linnard*, M.A. ... 271

Easier Forest Clearing—*Ir. J. A. Samson* ... 273

Improving Forest Trees—*C. M. Kaufman* ... 274

Radioactive Isotopes—*Kurt Hansen* 277

Taiwan's Huge Logging Drive—*Hamilton Wright* 279

Sisal—*A. E. Haarer*, F.L.S. 281

Boron Deficiency: 2. Recognition and Correction—*P. A. Oram*, M.A. 285

Two Hundred Years at Kew 288

Tasmanian Farming 292

New Publications 296

This Year's Royal 297

Agricultural Chemicals 303

World Crop Reports 304

Editor: Frank Cooke, A.R.C.S., B.SC., A.M.I.CHEM.E., E.D.

A publication of the Leonard Hill Technical Group. ENGLAND: *Leonard Hill House, Eden Street, London, N.W.1* (*Euston* 5911). U.S.A.: 92 *Lorraine Avenue, Upper Montclair, New Jersey* (*Plaza* 5-1127, *Pilgrim* 4-2484); 222 *N. Wells Street, Chicago* 6, *Illinois* (*STate* 2-5251); 1900 *Euclid Building, Room* 225, *Cleveland* 15, *Ohio* (*CHerry* 1-7565); 1214 *Villa Drive N.E., Atlanta* 6, *Georgia* (*Trinity* 2-2969); 2515 *Beverly Boulevard, Los Angeles* 57, *California* (*DUnkirk* 1-2241); 681 *Market Street, San Francisco* 5, *California* (*Exbrook* 2-2612); 121 *Ward Parkway, Kansas City, Missouri* (*Logan* 1-3880). ITALY: *Via Filippo Turati* 3, *Palazzo Giardino, Milan* (639367). SWITZERLAND: *John Anns, Maupas* 22, *Lausanne* ([021] 25: 41: 85) FRANCE: 63 *ave. Kleber, Paris XVIe* (*Passy* 31-30). SWEDEN: *Tunnelgate* 19*b*, *Stockholm.*

Subscription rates: 1 year £2; 3 years £5; Dollar rates: 1 year $12.00; 3 years $30.00 post free.

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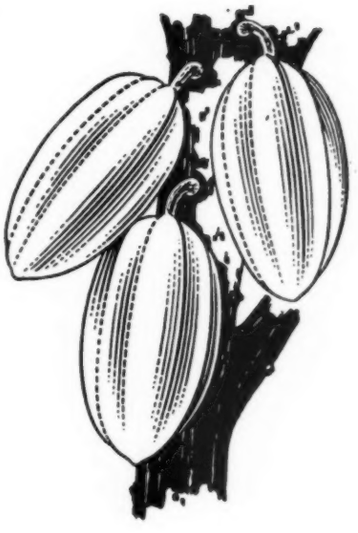

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Editorial Comment

More forest research

OF all the crops cultivated by man, forest trees have received least attention and the potentialities for improvement are as yet relatively unexplored. An event of considerable importance to world forestry is the extension of the British Forestry Commission's research station in Alice Holt Forest, on the borders of Surrey and Hampshire.

The opening of these magnificent new laboratories coincides with the decision of the Commission to plant a further half million acres of forest during the next ten years, with in addition a considerable increase in planting by private woodland owners.

The Commonwealth and, for that matter, world forestry is likely to benefit from this expansion of research work as the knowledge gained will be widely disseminated through such bodies as FAO, the Commonwealth Forestry Conference and the International Union of Forest Research Organisations.

Fertilisers and forestry

SPEAKING TO the Agriculture Group of the Society of Chemical Industry in London, Mr. M. V. Laurie, Chief Research Officer of the Forestry Commission Research Station in Surrey, said that in comparison with agriculture, there was only a very limited use of fertilisers in forestry, mainly because of the lack of knowledge of the conditions under which worth-while responses could be expected.

He reviewed the experimental work which has been done and commented on the inconsistencies of some of the results obtained and on the fact that, in some cases, the results had been negative. Where responses had been obtained, phosphorus produced the greatest growth stimulation; occasionally nitrogen, calcium and more rarely potassium were the elements in short supply. The effect of nitrogen manuring appeared to be ephemeral and showed the need for a form of nitrogen that is not leached out of the soil and is sufficiently slow-acting to produce prolonged growth responses.

In the tropics, curiously enough, tree crops, such as rubber, oil palms and coconuts have all shown marked responses to the application of NPK mixtures. In the case of coconuts, the essential need is for potash which is apparently the opposite of the results obtained with forest trees in Britain. Furthermore, evidence is accumulating to show the need for certain minor elements and this may possibly explain the lack of adequate response to the application of mixed fertilisers to forest trees in Britain where NP and K alone are considered.

Fertilisers are likely to be used increasingly in future because so much afforestation has been done on very infertile soils and the need for systematic long-term manurial trials, on several levels and including minor elements where pot trials have shown their deficiency, is indicated. The obvious difficulties are the long-term nature of the problem and the method of recording the responses as there is no crop to measure the results, other than the timber itself.

Building for the future

BY THE YEAR 2,000, approximately one-third of Israel's consumption of forest products will be supplied from local sources, according to Mr. Roswell Carpenter, U.S. Operations Mission forestry consultant, in his address to the Israel Society of Foresters, at the Bet-Dagan Agricultural Exhibition.

At present, Israel is not able to supply its own wood and is importing about 375,000 cu. m. of timber, valued at $23 million. However, widespread tree-planting over large areas will provide for the future; out of 200,000 acres of potential forest land, 50,000 acres have been planted since the establishment of the State of Israel in 1948. The principal species of trees intended for commercial exploitation are Aleppo pine and eucalyptus, followed in importance by Canary pine, Cyprus poplars, tamarisk and acacia.

The age of miracles

FEW PEOPLE give a thought to the many miracles of the organisation of production and distribution which brings our food to the breakfast table. Today, we in the ' west ' live in an age of plenty because science has produced new hybrid varieties of seed, the machine has speeded up age-old methods of agricultural production, agricultural chemicals are protecting our crops and our animals, fertilisers are making the soil more productive, and all the time scientists are seeking ways of assisting, emulating and improving upon the work of Mother Nature.

It is no use still to argue that this is an unnatural way of life and to look back to the ' good old days ', for in actual fact they were not so good for the majority of the population. As Prime Minister Macmillan has rightly said: ' We have never had it so good ', but how long this happy state of affairs can continue in the face of the explosive increase in world population is a matter for conjecture.

G.P. and A.P.

As Mr. F. A. C. Guelpin, Chairman of the Shell Chemical Co. pointed out at the opening of the new

fertiliser plant at Shell Haven by His Grace, the Duke of Northumberland:

'. . . world population, if unchecked, will increase in a geometrical ratio, while subsistence, i.e. food production, can only increase in arithmetical ratio. In the days of world expansion and the discovery of new lands, rich in natural resources, the Malthusian Theory was challenged, but now we are back with Malthus again. We are faced with a rapid acceleration of the population growth rate for two main reasons: first, the chemical and sanitary revolution has eliminated many diseases and reduced the incidence of others; secondly, the 20th century agricultural and industrial revolutions have provided supports for growing populations. We must now answer the question "can the production of food from the soil and from the sea be increased sufficiently to keep pace with the current and expected growth of the population?"'

Millions go hungry

In the 'east' (including all Asia, Africa and South America) things are not so good.

'Extensive regions, comprising more than half the world's population, suffer from the lack of food, adequate in quality and quantity to sustain their health, growth and vigour. The contrast in vital statistics between well-fed and ill-fed people are very striking when expressed in terms of calorie and protein intake. Malnutrition is a close and constant companion of poverty, both individual and national. It leads to impaired vigour and lowered vitality and thus to idle hands, and to much suffering which is preventable but not prevented. The scores of emaciated children, prematurely aged mothers and idle youth is the true measure of the human tragedy that can be traced directly to poverty and malnutrition',

according to Mr. B. R. Sen, Director-General of FAO, speaking at the Royal Commonwealth Society last month.

We do not live in two worlds – 'east' and 'west'. We – 2,750 million of us, increasing at the rate of 1.6% per annum – live in one world; and the peoples of the over-developed regions of the world which produce too much grain have a very real and direct interest in the promotion of the health, wealth and happiness of the under-developed regions, as we depend on them for so many of our raw materials and they provide the potential market for our manufactured products, such as agricultural machinery, agricultural chemicals and fertilisers.

Fertilisers for export

'*Am I my brother's keeper?*'—Genesis, IV, 9.

Fertilisers – and the credit facilities to purchase them – are very urgently needed in these under-developed regions. The main food-growing areas in the tropics get very little and some areas get none at all. If the problem were simply to increase the amount of food in the world, without regard to the distribution of that food, then the use of more fertiliser in the U.S.A. and the U.S.S.R. would probably meet all needs for at least a generation, and these countries would be well able to make the extra fertiliser. *But food must be where the mouths are.*

Fertilisers will only have their full beneficial effect when they become more amply available in South and East Asia, where the food shortage is more acute. These fertilisers will not be entirely synthetic, but there is not space to enlarge here on the part that biochemistry could play in devising methods of sewage disposal that satisfy the conflicting claims of economy, hygiene and aesthetics.

Such approaches to the problem of world feeding are of great importance, and it is possible that they can, on their own, supply a full solution to the problem, according to N. W. Pirie, F.R.S., in a recent address to the Royal Society of Arts in London.

Future of small farms

THE PRESERVATION and improvement of small-farm agriculture are receiving the consideration of the European Commission on Agriculture. This is a 22-nation body of FAO which examined a report presented by Prof. H. Priebe of the University of Frankfurt on the technical, economic and social problems besetting Europe's small farms. The Commission agreed that difficulties were many and complex and recommended that a small working party should study the problems of the small farms of Europe.

The Commission's conclusions are that the farm unit must be based on the full labour capacity of the family; better production must be created and labour costs must be reduced; intensified cultivation was needed and co-operative marketing could help to improve their economic position. Prof. Priebe, however, pointed out that the modernisation of small farms was a costly matter and could only be realised with outside financial assistance and advice on improved farm management.

Effect of farm size

In Britain, the effect of farm size and systems of farming on efficient agricultural production was considered by Prof. H. G. Sanders of the Ministry of Agriculture at a meeting of the Town Planning Institute in London. He pointed out that the problem is partly agricultural and partly sociological; and it is beset with human problems. Farms, he said, can be too big and, in some instances, production and efficiency could be increased if their size was reduced, for it takes a very good man to manage several thousands of acres of agricultural land well, and such men are not easily found. The proportion of very big farms, however, is low and the problem there is not so much that the farms are too big but that they are generally too small, for two-thirds of all the farms in Britain are between 15 and 100 acres.

Some countries have an even worse problem than Britain in that the farm holdings are very small indeed, or, worse still, are held in multiple ownership. In the Far East, the bulk of the agricultural properties are less than 15 acres in size, the majority are between 3 and 5 acres, and a very large number are even smaller.

Thus, in India the ownership of a single acre, a row of coconut trees, or even a single tree, may be shared. In countries which are predominately agricultural, the position is steadily worsening as with the increase in families, the properties are being fragmented by division and re-division, because there is generally speaking no alternative employment for the children, other than on the land.

It might be thought that with intensive cultivation, the smallholding could be more productive than larger farms. But this is not so because, with the use of modern machinery, fertilisers and agricultural chemicals, the larger farm is in a position to be much more productive. With populations rising everywhere the essential is the highest production per acre and not the maximum employment of labour. Employment and hours of work are important questions and need to be considered, but the first essential for any nation is the production of food.

Difficulties of small farming

Prof. Sanders summarised the difficulties of the small farmer in Britain as follows: Firstly – there is the personal aspect. He has too much to do and at the end of the day is too tired to read articles on farming, and he is generally too shy to believe that the services of the advisory officers of the N.A.A.S. are intended for him. He has also little opportunity to get to field demonstrations and farm inspections organised by the Ministry. Thus it is easy for the man of small acres to get into a rut.

His second disability is economic. In most cases he is very short of capital and is reluctant or unable to obtain credit. Furthermore his turnover is too small and in order to increase his income he has in effect to increase his acreage by buying expensive concentrated foods.

The third difficulty lies in his inability to apply modern methods and machines. The small farmer has either to do without the assistance of modern machinery or else he is likely to find himself spending more than he can afford on machines. Something can be done by co-operative ownership but this is not easy to arrange in the busy seasons and the machines are not always satisfactorily maintained by the individual members of the society.

Within the last year or two, there has been a notable development in machinery syndicates – see WORLD CROPS, 1959, **11**, 239. These are small groups of neighbours who get together and own between them a range of expensive implements such as combine harvesters, ditch-cleaning machinery, pick-up balers etc. According to Prof. Sanders, there are now 30 of these syndicates in existence and he expects to see considerable development on these lines in the future.

The fourth difficulty facing the small farmer is the limited range of crops which he can produce profitably. Market gardening can only be taken up by a small proportion of them because the market for horticultural produce can easily be over-supplied – the small farmer is thus forced into milking, pigs and egg production – three commodities which are being over-produced at present. The result is these industries are passing into the hands of the bigger men and with such large-scale production the prices of meat, milk and eggs are low.

Small farm improvement

There is one over-riding argument in favour of the small farmer – it is the simple argument that he likes doing it for it is the sort of life he wants, and if he can make a living at it he is prepared to put up with pretty low standards. He is usually an independent, self-reliant and useful member of the community and his farm should be encouraged and helped to grow in size so that his standard of living is adequate.

Under the Farm Improvement Scheme of 1957, special encouragement was given to small farmers to amalgamate their holdings but there was little response. Now there is a scheme called the Small Farmer Scheme to help small farmers and they are defined in two ways. Firstly, they must have an acreage of between 20 and 100 acres, and secondly their operation should require a labour demand of between 250 and 450 man-days to a year. Farms, below 20 acres in size are excluded because it is not thought that they can provide a decent living for a man and his family.

Before receiving financial assistance, the farmer has to produce a plan of improvement and it is only after he has done this that he qualifies for financial aid on the basis of subsidies provided for various farm operations. Thus the State is helping those who are willing to help themselves.

Apples, vinegar and toddy

WHAT IS TO BE DONE with Europe's surplus apples? One suggestion, made by Mr. C. C. Norbury, member of the Fruit Committee of the National Farmers' Union, that some of the surplus could be used to make vinegar, provoked an immediate reaction – ' You can't do that, the vinegar industry is traditional! '

Mr. Norbury was speaking at a recent meeting in London, jointly attended by the S.C.I. Food Group and the National Farmers' Union at the invitation of the Commonwealth Fruits Council. Good quality apples are more plentiful than they used to be. Larger acreage of orchards, greater yields per acre, and greater discrimination among consumers have lowered prices and increased the surplus of lower grade fruit which is becoming increasingly difficult to sell. Mr. Norbury's theme was that more apples should be used for processing and preserving, although, as another contributor to the discussion pointed out, if only one extra apple a week could be foisted on to

each school child in the country, much of this country's surplus could be cleared off.

Why should not some of the apples be turned into vinegar? It would be interesting to know just how much this would affect the traditional vinegar manufacturing trade. It is true that malt vinegar of the established kind is a complex product of subtle flavour and aroma, and its manufacture is a traditional art. But not all the vinegar of commerce is of this kind, and there may be room in the food industry for apple juice vinegar. Vinegar can be made from many sugary liquors that ferment, although of course the products are different in flavour and variable in quality.

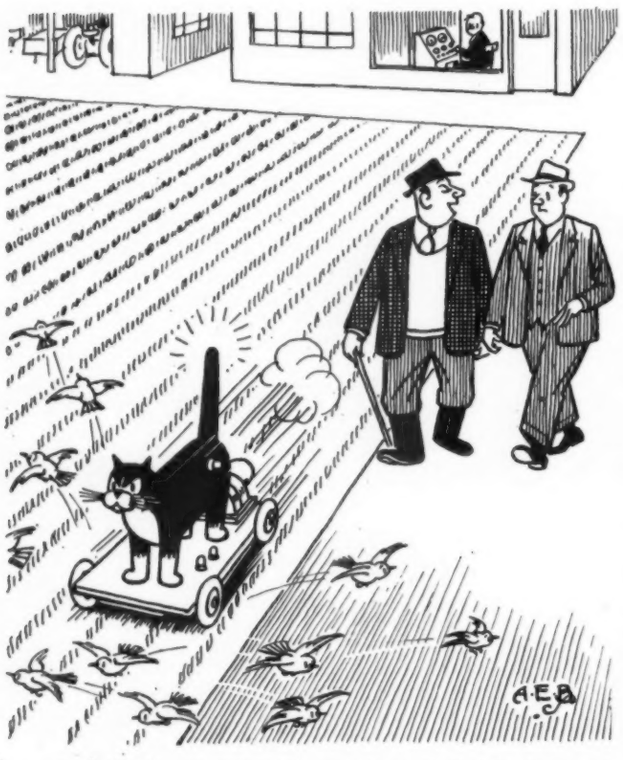
In Ceylon, vinegar is made from toddy, the fermented sap of the coconut palm. Coconut toddy vinegar, properly made, is reported to be of such excellence that ' on its merits it would find a ready sale in the world's market '. The toddy vinegar industry started there in about 1924, and in spite of being handicapped by the common practice of adulterating the vinegar with imported acetic acid, the trade has been a useful adjunct to the coconut industry and has contributed materially to the Island's economy.

The beverage . . .

TEA IS a beverage containing the stimulant caffeine, present to the extent of $\frac{3}{4}$ grain in a cup of good tea. However, coffee and maté, or Paraguay tea, also contain caffeine, so a definition of tea cannot be based solely on the presence of this alkaloid.

Tea is made from the young leaves of plants of the species *Camellia sinensis*, and when they are prepared in a definite manner they give an infusion that is accepted by the professional tea taster as tea. The taster demands certain tastes and sensations in the mouth, known as briskness, strength, quality, body and pungency. He also expects certain aromas, including some which are fragrant, like flowers, some sharp or acid, like herbs, some burnt, like caramel, and perhaps some of the caprylic smells. Caffeine is not specifically recognised by the taster, but if the leaf retained all its other properties but ceased to make caffeine the beverage would soon lose its popularity.

Chemical analysis, based on paper chromatography, can be used as an aid to defining tea. Certain classes of phenolic bodies are present in tea leaf and not in other camellias.



'. . . and this is our automatic remote-controlled bird-scarer'

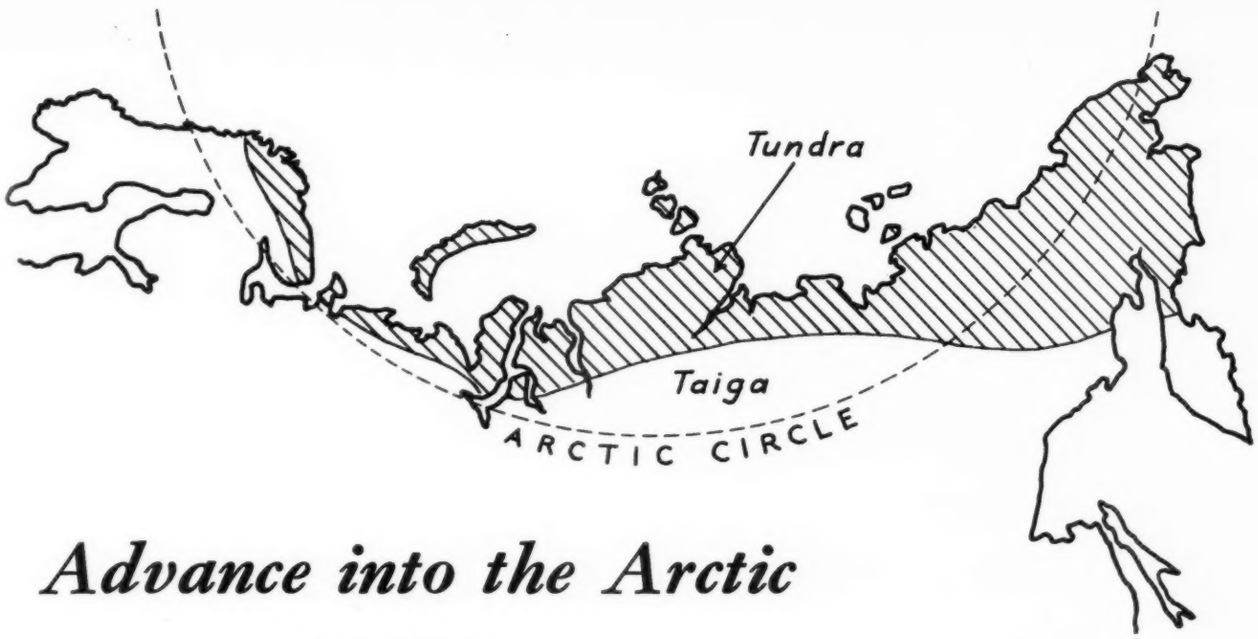
. . . and the plant

THE BOTANICAL classification of tea is simple and indiscriminating in such a manner that it cannot be linked up with the commercial properties of tea liquors. The tea plant, *Camellia sinensis*, is a species which includes a whole range of varieties, from the hardy China bush with small, erect, matt leaves to the shade-demanding 60-ft. tree of the Lushai type with drooping leaves up to 14 in. long. The classification is based on seed, fruit and floral characteristics, with no consideration of leaf form. Nevertheless, two varieties are now officially recognised which are related to leaf, the China, var. *sinensis*, with the small leaf, and the southern form, var. *assamica*, with larger leaves.

The Section ' Thea ' in the camellia genus also includes *C. taliensis*, a tree up to 20 ft. high, with fairly large leaves of the China type. When tea is made from the leaves of this plant the taster accepts the product as tea. Another plant, *C. irrawadiensis*, also a tree about 20 ft. high, stands between *C. sinensis* and *C. taliensis* in floral characteristics. Yet the leaf of this plant is devoid of caffeine and fails to produce tea accepted by the taster. The chemist would include *C. taliensis* in the species *C. sinensis*, and exclude *C. irrawadiensis* from the Section ' Thea '.

Thus the botanical classification of tea plants is not of great use to the tea industry.

The practical planter in North-East India recognises several tea varieties which he has selected from the hybrid swarms and ecotypes occurring in Assam. Years of experience have shown which types flourish in certain districts and which produce the best teas. The planter recognises the following sub-varieties, based wholly on leaf form: China, China and Assam hybrids, Cambodian, the light- and dark-leaved Assam, the Manipuri, the Burma and the Lushai types. Those growing best and making the best teas in North-East India are the dark-leaved Assam, the Manipuri and the Burma types. In Darjeeling the famous flavour is given only by a China hybrid plant.



Advance into the Arctic

W. LINNARD, M.A.

THE average January temperature in Verkhoyansk (Siberia) is −58°F, the average for July is only 59°F, and the growing season is about three months per annum. These figures do not, at first glance, seem to indicate favourable conditions for any plant growth and farming in general, but not even the vast Soviet Union can afford to ignore its considerable areas north of the Arctic Circle, where temperatures such as these are found.

For many years, and especially since the war, efforts have been made in the U.S.S.R. to develop the Arctic, not only as a source of such raw materials as coal and iron, but also as an agricultural area. In these high latitudes agriculture must be regarded as a successor or a concomitant of forestry.

Vegetation zones

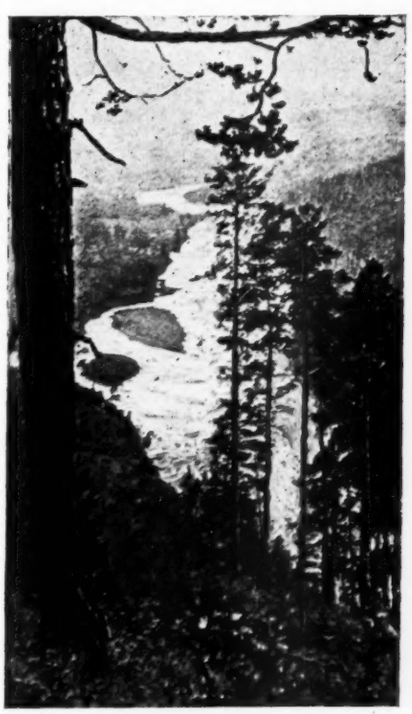
In the Soviet Arctic there are two clearly defined vegetation zones, the *taiga* and the *tundra* (see map). The taiga is a dense coniferous forest belt stretching almost without interruption across the country and extending in places considerably north of the Arctic Circle. In the west of the country it is composed of spruce and fir; east of the Ural Mountains the main species are Siberian spruce, *Picea obovata*, fir and pine; while further on again, east of the River Yenisei, larch predominates.[1]

In places, a narrow belt of birch scrub exists between the taiga and the tundra proper. The vegetation of the latter zone consists mainly of grasses and lichens,[2] though some willow and birch are found.

Though these two main zones are quite distinct, it is an over-simplification to say that no overlap exists. There are strips of trees along the rivers which pass through the tundra and empty into the Arctic Ocean, and there are *ostrovy** of birch and spruce deep in the tundra itself, which maintain a precarious existence, but which indicate the possibility of extending the area of useful vegetation northwards. Plans for opening up the Arctic are aided by the fact that there is a general warming up of the area. It has been calculated by Andreev[3] that the taiga has been advancing naturally into the tundra at a rate of about 200 metres a year during the last century, so the *ostrovy* may be regarded as outliers which will in time become assimilated into the forest belt.

Aerial seeding

To assist and accelerate this natural process plans are afoot for aerial sowings of pine and spruce seed on the southern parts of the tundra, and also around the *ostrovy* so as to extend them. Mechanised tillage and fertiliser application are also envisaged to facilitate the establishment of air-sown tree seed. Together with the organisation of extensive fire prevention and control projects, this constitutes a far-sighted and concrete programme of Arctic development.



Typical Taiga country

* Ostrovy = islands.

Windbreaks or shelterbelts

In addition to the intense cold, the other major climatic factor militating against Arctic farming is wind. The U.S.S.R. has been a pioneer in work on shelterbelts, both in theory and practice. The best shape, orientation and species composition of shelterbelts has been determined and significant improvements in yields have been recorded from fields protected in this way.

Quite apart from the forestry importance of tundra afforestation schemes, and extensive fellings in the taiga belt, there is a great potential future for farming proper in the region under consideration. The body in charge of the development of agriculture in the Arctic is NIIPZZhPKh (Scientific Research Institute for Polar Agriculture, Livestock Farming and Industry). Work is carried out at a number of the Institute's stations north of the Arctic Circle on practical problems of farming.

It has been found[4] that grain and forage crops can be grown between shelterbelts in these latitudes. As the prevailing winds blow from the north in the winter and from the south in the summer, an east-west orientation of the belts is advisable. So placed they give good protection to the south for a distance equal to seven to 10 times their height, and to the north for 12 to 14 times. As well as reducing wind speed, the shelterbelts result in more even snow cover in winter, better soil and air temperature conditions, and higher levels of moisture content in the soil. Mixed shelterbelts of shrubs and coniferous and broad-leaved species are best and quick-growing species, such as birch and larch, should be used. Belts consisting of two or three narrower strips of trees are better than those of a single wide strip.

Seed and seed treatment

Progress has also been made in overcoming the drawback of the short growing season in the Arctic by using the technique of vernalisation, which was first developed in the Soviet Union. Vernalisation involves the treatment of plants with low temperatures in the initial stages of their development from seed. This induces rapid development towards a physiologically older condition, *i.e.* it shortens the interval between sowing and flowering. For example, winter cereals can be sown and brought to flower in one season. The seed is moistened to allow germination to begin, and when the tips of the radicles just begin to emerge the seed is exposed to temperatures of just above freezing point for a few weeks. Seed thus vernalised acquires the properties of spring varieties[5] and when sown in the spring produces a crop in the summer of the same year.

Hybridisation is another possible way of obtaining plants capable of developing in the short Arctic growing season. Hybrid maize seed, which can produce two crops a year in the south of the U.S.S.R., shows that hybrid vigour may be of considerable use in the north also.

Rapid harvesting

To harvest large acreages in a short time before the winter descends, reliable machinery of high output is necessary. An outstanding example of this is the 60-h.p. self-propelled combine-harvester, the SK-3, which has a cutter bar 5 m. wide. It is a grain tanker model with, in addition, a 6.5 cu. m. capacity container, mounted at the rear, to which straw and chaff are passed. They are compressed there and, when the container is full, are ejected automatically in a large heap.

These heaps are easier than windrows to harvest later and are less prone to rain damage. Experience in West Siberia with this combine, and the PK-2.0, which also has a container into which straw and chaff are pressed, has been highly successful. Shift systems are also worked on the *kolkhozes*† to get the harvest in, searchlights being fitted to the machines to enable round-the-clock work.

This short survey gives some indication of the efforts being made to develop the resources of the Soviet Arctic and make them an asset in the national economy. Despite the formidable and almost insuperable difficulties imposed by nature, real progress in agriculture has been, and is continuing to be, made in the 'Frozen North'.

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† Kolkhoz = co-operative farm.

Fresh water from Sea water

Solar stills are at present the most simple and effective method of desalting sea water. The sea water is piped into shallow pans and the vapour produced by the concentrated sun's rays is condensed by a glass cover. The condensate, relatively free of dissolved salts, is collected in troughs. The process is slow and inadequate.

The distillation process, which uses multi-effect evaporators, can be integrated with cheap electric power and has been widely adopted, but, according to Mr. Sheppard T. Powell, of Baltimore, an authority on the subject, the cost is about $1 per 1,000 gal. of water.

A new process, based on direct freezing, has been developed which he estimates will desalt sea water at a cost of between 50 and 60 cents per 1,000 gal. and will produce fresh water containing only 500 parts per million of dissolved salts. A pilot plant is now under construction by the Carrier Corporation in the U.S.A. and subsequently a full-scale plant with a capacity of nearly a million gallons of water a day is to be built.

In this process a part of the sea water under treatment is evaporated in a partial vacuum, removing sufficient heat to reduce what remains to a condition of frozen slush. At this lowered temperature ice crystals are formed and after successive washings to remove the adhering salts fresh water is obtained. Laboratory trials have shown that this particular method is technically and economically feasible.

We regret that this issue of WORLD CROPS has been delayed because of the dispute in the printing industry. We apologise to our readers for any inconvenience.

Easier Forest Clearing

IR. J. A. SAMSON*

IN regions of heavy tropical rains the climax vegetation is forest, and the forces of nature combine to establish and maintain the forest. Man faces stiff opposition when he wants to alter the situation.

Land clearance in such regions starts at the beginning of the dry season and it can be heavy and unpleasant work. The trees have to be felled in such a way that they can dry up and so be burnt easily. The total cost of clearing in this way is about £10 per acre.

After many days of hard work carried out at considerable expense the land is ready for planting with maize. Subsequently bananas and the permanent crop, *e.g.* coconuts, citrus, coffee or cocoa, will be planted. In the interval, however, the soil is for a time left bare and unprotected against the burning heat of the sun and the action of heavy tropical downpours. Organic matter in the soil is burnt up, soil structure destroyed, topsoil is lost, and nutrients leached away – indeed a serious wastage of the resources of nature.

The method here described is a promising alternative. It consists of two measures: the killing of the forest trees by chemical means and the establishment of a nitrogenous cover crop in the cleared areas, so as to prevent the re-establishment of secondary forest growths.

The cover crop

In temperate climates grass is regarded as the saviour of soils. In the same sense *kudzu* is the saviour of soils in the wet tropical climates. Tropical kudzu, *Pueraria phaseoloides*, a nitrogenous cover crop, is a vigorous climbing plant, an excellent suppressor of weeds, a prolific producer of organic material and a good nitrogen fixer. In addition, the leaves, containing 18% protein, make excellent cattle feed. By strip harvesting the fodder the crop can be maintained almost indefinitely.

For continuous good growth kudzu needs adequate moisture and light.

Fig. 1. Typical rain forest in Surinam, showing a tree that has been girdled

Surinam has some 90 in. of rain yearly and so kudzu does well, but it is evident that growth slows down or even ceases during months with less than 4 in. of rain. Elsewhere in the West Indies it is unlikely that it will be a success in areas that have less than 70 in. of rain.

In Surinam kudzu does not seed much and the seed is not easily harvested. Furthermore, it is not an easy matter to establish this cover crop from seed, as the young seedlings have very small leaves and do not grow vigorously. It is, however, fairly easy to propagate it from the runners, which root well. A good method is to place baskets with soil in a kudzu plot and lead the stems through the baskets. After about six weeks they can be cut off and are ready for planting out.

It has been found here that 50 baskets per ha. or 20 per acre are enough, if they are established right at the beginning of the rainy season. For Surinam this means April. All through the rainy months (averaging some 12 in. of rain) the plant keeps on growing and by August each may cover several square yards of ground. After a slowing down in the dry season growth is resumed when the rains return and usually the kudzu has practically covered the area by the end of the second wet season.

The cost of the plants in baskets is low, provided there is a small kudzu plot nearby. Transportation then will be negligible and the total cost of establishment may be about 12*s.* per acre.

Tree destruction by chemicals

At one time this was done by girdling the trees and applying sodium arsenite to the wound (Fig. 1). As wild palms do not have a bark layer, it is necessary to drill three or four holes around the stem and fill them

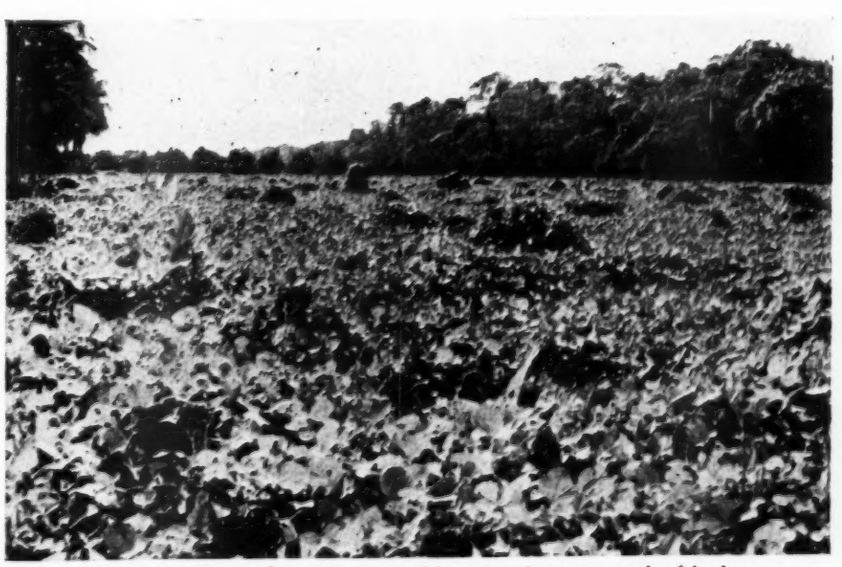

Fig. 2. A forest clearing protected by a continuous growth of kudzu

* Director of Agricultural Services, Surinam, South America.

with arsenite. The trees die, but only dry slowly, and it is a long time before they fall and rot away. For this reason this method of clearing cannot be recommended.

There is a better method used in Uganda and now applied on a fairly extensive scale by the Forest Service in Surinam. Stems are lightly sprayed at shoulder height with a 5% solution of 2,4,5-T butylester in Diesel oil. The trees die slowly and it takes about a year before they fall, but they rot away completely, including the roots. For large areas the cost of this operation, killing all trees over 2 in. in dia., has been estimated by the Surinam Forest Service to be £6 per acre.

Combined operations

The method is thus a combined operation. At the beginning of the wet season the kudzu is established along the margins of the forest and in dry, open clearings at about 15-yd. intervals. At the onset of the dry season, in August or early September, the trees are sprayed with 2,4,5-T. The effect at first is hardly noticeable, but by April in the following year most of the trees will have lost their leaves.

The kudzu now has what it needs – plenty of rain and plenty of light. Before secondary forest growth has any chance to establish itself it is smothered by the kudzu. Meanwhile the trees have fallen and are slowly rotting away. By the end of the second wet season the forest will have been replaced by a more or less continuous kudzu cover (see Fig. 2).

Planting the permanent crop

In this cover young coconut seedlings or citrus plants can be set out, but the kudzu has to be prevented from climbing these trees. This can be done easily and at little cost by inspections at monthly intervals. This monthly check is essential, as a month or two of neglect could be enough for the kudzu to smother the young plants. This system is not suitable for coffee or cocoa, as their planting density is four times that of citrus and about eight times that of coconuts, and this would make the cost of keeping young trees clear of kudzu prohibitive. It would, however, be possible to establish shade trees and put in the coffee or cocoa later.

Improving Forest Trees

C. M. KAUFMAN*

American foresters and those engaged in timber production are convinced that the increasing needs of the world can be met by tree improvement and improved forestry practice.

IN spite of predictions of timber famine, the U.S.A. has always had an abundance of wood. Even in the face of the rising population and increasing demand for wood no shortage is anticipated. This confidence is due to improved forestry practice and research to ensure adequate increases in production. Tree improvement by the application of the principles of genetics is one of the means now being used to increase the annual production and the quality of forest growth.

Foresters have been slow to use this

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Cone bearing a slash pine graft. Cones on carefully selected scions may be control-pollinated for early progeny testing

technique, partly owing to the previous abundance of wood and partly to the long life cycle of trees which appeared to present impossible difficulties to genetic improvement. Since about 1950 this attitude has changed due to advances being made in several central and north European countries and to a revaluation of the prospects for tree improvement in America.

Variations in trees

Variations in forest trees controlled by heredity and offering prospects for tree improvement include the factors of rate of growth, straightness and uniformity of stem, branching habit, wood density, resistance to insects and disease, resistance to fire damage, oleoresin production in slash and long-leaf pines, and other qualities of lesser significance.

Thus pine trees have been found which grow three times faster than surrounding trees of the same age; slash pines, producing over three times the quantity of gum produced by average trees are also known; trees having small branches that drop off readily after they die and produce only small knots, yield higher grade timber than do those with large branch stubs. Wood density or specific gravity is also a factor of major importance, because of the greater structural strength of dense material and the higher pulp yield for a given volume of wood.

Selection and breeding

In forestry the methods used for capitalising on these variations for the improvement of trees are selection and breeding.

The finest trees in the forest are selected by comparison with adjacent trees of the same age. Trees showing outstanding features are marked so that they can be used for the collection of scion material and for research purposes. Progeny tests are made to determine if these qualities are genetic and are transmittable to offspring or are due only to a favourable environment or some special cause.

Then the advantageous characteristics are incorporated into the offspring by controlled fertilisation of the conelets of a selected tree with pollen from a selected source. This may involve crossing races or strains of the same species, or hybridisation between species. A series of crosses may be used to incorporate the exceptional height growth of one species with the early diameter growth of a second and the local adaptability of a third. These operations may have to be continued over several generations until the desired results are obtained.

An outstanding example of a superior tree. This tree is 60-ft. tall, 11-in. diameter at breast height (d.b.h.) and 17 years old. It has a volume superiority of 3.63 times the average, a height superiority of 8-ft. and wood specific gravity of 0.63

Work in progress

In Florida tree improvement research is being done by the Lake City Research Centre of the U.S. Forest Service. The systematic examination of several thousand trees has resulted in finding 12 slash pine trees yielding at least twice as much gum as the average for trees of that age and size. Later tests showed that these increased yields were transmissible and steps were taken to establish plantations of grafted cuttings from these superior trees for the ultimate production of seeding stock of high gum yielders.

Seed gardens

The School of Forestry of the University of Florida has stressed the importance of the establishment of gardens for the production of seed from trees selected for their outstanding qualities of growth, form and other desirable characteristics. Surveys of the timber land holdings of 10 pulp and paper companies has resulted in the location of approximately 500 trees growing over two and a half times as fast as neighbouring trees of the same age and outstanding for their straightness of stem, disease resistance and other important characteristics.

Cuttings or scions were removed from these trees, grafted on two-year-old potted root stock and then returned to the co-operating companies for planting out in their seed gardens.

Over the past four years this has resulted in the planting up of about 250 acres of seed gardens of grafted slash and loblolly pines. It is anticipated that in 15–20 years these orchards will produce sufficient seed each year to produce seedling stock for approximately 60,000 acres. Additional

seed gardens are being established by the companies.

Progeny tests

Even though the trees selected for cuttings appeared on the available evidence to be highly superior to the surrounding trees, outward appearances can give no absolute assurance that true genetic superiority exists.

This can only be determined by progeny tests, which are accomplished by dusting the conelets on the grafted trees at the correct flowering stage with pollen obtained from selected trees and observing the qualities of the offspring. These tests will show that some of the selections have true genetic qualities and so will produce offspring of highly superior quality, but others are no better than average. Seed orchard stock with no genetic superiority can subsequently be removed and replaced with grafts of proved superior parentage.

Attention is also being given to the stimulation of pollen and seed production and to determine the degree of variation within the natural range of certain tree species. A special study is being made of the effect of differences of climate on these variations.

The total potential for improvement is considered to be tremendous. Conservative estimates are that an overall improvement of 15 to 30% in volume or value may be expected.

Other agencies

Tree improvement research is also being carried on at other centres. The Southern Institute of Forest Genetics was established at Gulfport, Mississippi, in 1954 by the U.S. Forest Service as a centre for improvement of forest trees. Research is also done by the U.S. Forest Service at Crossett, Arkansas; Stoneville, Mississippi; Macon, Georgia, and at Asheville, North Carolina.

Tree improvement research is carried on co-operatively with industry by the Texas Forest Service, and the School of Forestry at North Carolina State College. Work is also being done in the forestry schools at Alabama Polytechnic Institute, Louisiana State University and the University of Georgia, with the co-operation of the Georgia Forestry Commission. The Tennessee Valley Authority also has an active programme covering the next 10 years.

Conclusions

Very encouraging advances are being made with, at present, the southern pines, particularly slash and loblolly, receiving the most attention. There are many other important hardwood species that could be improved by selection and breeding.

Improved forest management, the use of fertilisers and better tillage practice are being considered, but the application of genetic principles is the major line of improvement.

Forest Tree Seed

The Forestry Commission recently suggested the formation of a Forest Tree Seed Association of England and Wales. An *ad hoc* committee comprising representatives of the nursery trade, the Country Landowners' Association, the Royal Forestry Society of England and Wales and the Forestry Commission have drawn up the draft constitution.

It is to be a voluntary association, representative of all involved in the collection and marketing of tree seed and in the rearing of forest planting stock. It will not, itself, deal commercially with seed and plants, but will assist its members to produce and market seed and plants of known good parentage. The Secretary is Mr. E. S. J. Hinds, O.B.E., Forest Tree Seed Association for England and Wales, Forestry Commission, 25, Savile Row, London, W.1.

The main object of the new association will be the operation of a 'seed certification scheme' under which certificates of origin will be issued for seed and for plants from approved seed sources.

World Seed 1961

F.A.O. has instituted a world campaign to promote the use of better seeds, with the aim of bringing to the attention of agricultural producers throughout the world the value of seed of improved crop varieties and of high quality as a means of increasing world food production. The Organisation has designated 1961 as an International Seed Year and, during this year, special campaigns will be conducted in member countries. The planning and management of the campaign in the U.K. is to be undertaken by the Seed Production Committee of the N.I.A.B.

Timber Workers' Problems

For the first time an extensive, systematic review of labour conditions in the timber industry has been made available. This was prepared by the International Labour Office and was considered by a technical meeting on the timber industry in Geneva.

The report on accident prevention found that in practically all countries for which statistics are available, accident frequency rates in the timber industry were amongst the highest. The reasons for this, and practical measures for accident prevention are discussed in the report.

A large proportion of accidents is caused by a lack of knowledge of the work and fatigue. It is pointed out in the report that timber harvesting requires an energy consumption of 5,000 to 6,000 calories a day. This may be compared with 3,000 to 4,000 for a factory worker and less than 3,000 for a desk worker.

World Hunger Campaign

Europe's agricultural production has increased 'surprisingly rapidly' since the Second World War, Mr. B. R. Sen, Director-General of F.A.O., told the European Commission on Agriculture. He said that this was due to a generally favourable economic climate combined with extraordinary technical developments, an increase in investment, and a higher degree of co-operation among the European countries.

Nevertheless, a number of problems remain to be solved, such as the difficulties posed by the agrarian structure, the need to improve agricultural and nutritional education, research and advisory services, the need for the strengthening of market research and marketing generally, and increasing productivity. Through new political developments and, in particular, in consequence of the trend towards European economic integration, new problems were always arising.

Radioactive Isotopes

An Instrument of Agricultural Research

KURT HANSEN*

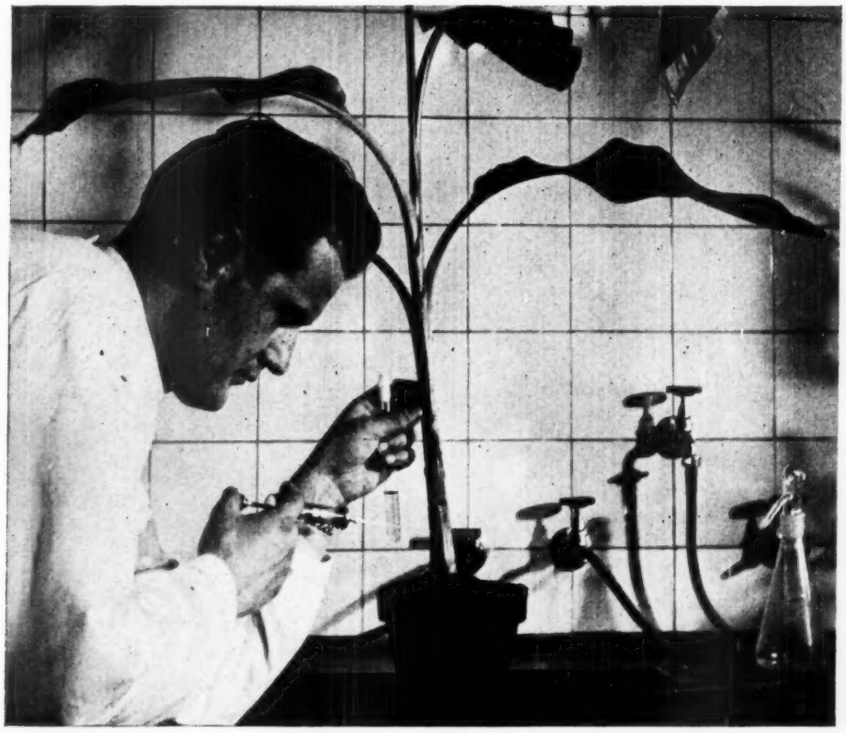
IT is possible for the atoms of certain chemical elements to exist in several forms known as isotopes. These are atoms which possess the same chemical characteristics, but are of different atomic weight; there are stable and unstable isotopes – unstable in that they can change from one form of the element into another. The latter are known as radioactive isotopes because when they break down they emit nuclear radiation and lose atomic energy. The change may be of short duration or may go on for hundreds of years with fissional energy being constantly emitted in the form of rays, either straightforward corpuscular radiation (α or β rays) or the more penetrative wave radiation ('x' or gamma rays).

The tracer technique

A common feature of all three kinds of rays is that they cause ionisation of the surrounding air. This can be detected or measured very precisely by the use of photographic emulsions (see WORLD CROPS, 1958, **10,** 66), by a scintilloscope, or by use of Geiger counters. With the Geiger counter it is possible to determine 0.000,000,000,1 g. of an isotope when in extreme dilution and this is an order of magnitude which it has hitherto been impossible to detect or measure by any of the usual chemical or physical means.

Thus the presence of a pesticide, herbicide, fungicide, drug or a nutrient element in extreme dilution in the tissue of a plant or animal can be detected or measured, provided it is associated with such radioactive material. The isotope is known as the tracer, and the radioactive pesticide, herbicide, fungicide or fertiliser is described as 'labelled' material.

Just as the course of an underground stream can be traced by adding a dyestuff to the water, so is it now possible with labelled material to follow the course of a chemical compound through an animal, an insect, a plant, or even a tractor engine by incorporating a radioactive isotope or tracer into the drug, the pesticide, the herbicide, the fungicide, the fertiliser or the lubricant, as the case may be.



A chemist injecting a radioactive substance into a plant in one of the laboratories of the Biological Institute at Leverkusen. This method is used to trace the flow of a new chemical under examination through the plant system

The basic idea in associating radioactive material with these chemical compounds is to determine the mechanics of their operation – where they go, what they do, how much is used effectively and how much is wasted by fixation, destruction or leakage, according to the type of problem.

The importance of the tracer technique in agricultural research is apparent. It will answer such questions as what happens to a given substance when it is applied to the plant either through the roots or leaves, and how much is applied uselessly; how and where it enters the plant and what happens when it gets into the sap stream; where it migrates and where it is concentrated or deposited; the speed of translocation; how long it will remain effective, and how long there are any pesticide residues in significant quantities remaining on the harvested crops.

Production of labelled materials

The radioactive isotopes or tracer element are produced at Harwell or Amsterdam. They are built into the insecticide, herbicide or fungicide in the Elberfeld factory of Farbenfabriken Bayer and the resulting formulations or labelled materials are either used in their own laboratories in field stations at Leverkusen, near Cologne, or are sent overseas for testing their new products under different conditions on a large variety of crops and pests under field conditions.

The isotope laboratory at the Elberfeld works is a nine-storey building in which are housed laboratories for the formulation, testing and packaging

*Isotopes Laboratory, Elberfeld, Germany.

of labelled materials made from radioactive carbon, C^{14}*; iron, Fe^{59}; phosphorus, P^{32}; and iodine, I^{131}. Naturally, as these are highly dangerous materials to handle, the most elaborate precautions are necessary to ensure that no unfortunate accidents occur before the material is sufficiently diluted to be safe to use with normal precautions.

The laboratories are spacious and well lighted ; the ceilings are particularly high, and they are tiled from floor to ceiling and are kept spotlessly clean. The basis of waste disposal is dilution either with air or with water, large volumes of both being required. Any dangerous wastes are disposed of underground and very dilute solutions which are not dangerous go direct to the sewers.

Handling dangerous materials

In those rooms where dangerous operations are carried out, the illuminated fume cupboards are of special construction: the air is changed 20 times an hour, there is lead insulation between floors, and the room has a heavy lead door, 3 tons in weight. There is a central control panel with a system of lights to indicate the condition of the air in each laboratory.

All operations in the fume cupboards take place behind lead shields and all manipulations are made by ingenious long tongs operating through a universal joint set in the glass windows of the fume cupboard. With these the operator can lift, shake and manipulate glass equipment and can pick up, fill, close and seal small glass bottles containing labelled formulations in perfect safety. To leave his hands free for these operations, gas, water, light and electricity and the supply of ventilating air are by remote control through foot pedals.

The long tongs and special grips are of most ingenious design and with practice the operator can carry out quite complicated routine operations both quickly and smoothly. When his work is completed the operator sheds his clothes completely, takes a bath and changes into his ordinary clothes. The laboratory clothes are, of course, washed and tested before being used again within the laboratory.

With increasing dilution the radioactive materials become less and less dangerous, and so, while the radiations from a plant or animal under study may be measurable, they no longer constitute a risk.

This very brief account is only one aspect of the enormous volume of work involved in the testing of a new agricultural chemical prior to its official acceptance for use in agriculture.

An operator in the Isotopes Laboratory at Elberfeld manipulating a small flask containing radioactive material, using a long tong. There are other instruments for lifting, filling, closing, sealing and packing small bottles of 'labelled' pesticides

* The inactive form of carbon is, of course, C^{12}.

International Wheat Agreement

The U.N. Wheat Conference in Geneva has finished its work. It has agreed the text of a new three-year International Wheat Agreement to replace the present one, which expired on 31 July. The new Agreement meets the objections which caused the U.K. to decline to join the old Agreement and this Government has now decided to join the new Agreement.

The International Wheat Council is now required to make an annual review of the world wheat situation, including problems of surplus disposal, and to study the means of encouraging the consumption of wheat. The rights and obligations of members are much simpler and there will be no country quotas for imports or exports. There will be no need in normal conditions to impose any restrictions upon the freedom of traders to buy wheat where they choose. The maximum price under the new agreement will be 10 cents less than under the present agreement.

A trainload of cypress logs passing over a trest'e-bridge

Taiwan's Huge Logging Drive

HAMILTON WRIGHT

TAIWAN (Formosa), is reaching above the clouds to obtain giant cypress trees for its domestic needs and to meet export orders. Korea alone, has ordered more than half a million railway sleepers—an order worth U.S. $2,225,000 to the national economy.

The operations of cutting, trimming and shipping the logs from the forests, more than 6,000 ft. above sea-level, is a remarkable story. With perhaps the exception of Switzerland, no other country has the same problems in bringing big trees from forest to sawmill, but on Taiwan it is being done mostly by man-power, and human ingenuity.

At the end of the first stage of the journey. Moving a loaded truck into position for launching into space

From Lotung, a substation at sea-level, to the lumber camp at Taiping-shan is only a 40-mile trip but it involves a minimum of five hours travel, along a narrow guage railway in tiny passenger coaches seating five to six people. Sandwiched in between, there are three separate and all equally hair-raising cable-car rides that cover more than 4,000 of the 6,000 ft. ascent to the Taipingshan forestry station. This is one of seven depots where the logging operations are conducted. They are all in areas where the choicest trees, some believed to be more than 1,000 years old, are to be found—and they produce roughly about 80,000 cu. m. or about 11 million board ft. each year.

Of the 8,000 people engaged in this industry in Formosa, about 2,000 work in these seven sub-stations. The loggers operate in teams of two—one using an axe, the other a shark-toothed saw, more than 8 ft. long. Together they can fell an 80-ft. cypress in less than an hour, strip it of its lighter limbs, and prepare it for shipment. The timber is cut into small sections at a nearby dragline and steam donkey-engine station, three or

four tons of logs are loaded on to small flat trucks, stapled together by huge spikes to prevent them from slipping, and then sent on their way down the mountainside – a 2 to 5-day trip to the sawmill.

Petrol-powered donkey-engines haul the trucks, 10 or 12 at a time, along the precipitous, narrow-guage railway that snakes its way through the mountains. At each of the three cable-car stations on the way down, powerful, hand-operated, block-and-tackle units lift the 4-ton load from each truck and lower it into space. The cable-way operates solely by gravity, with safety cables and man-powered brakes as the only means of check.

Logging on Taiwan is an all-the-year-round activity—with no 'seasons' —and the present unusual rush is to complete the Korean order.

Within the next few months, logging operations are to begin at the new Ta-Hsueh-Shan logging station, in an area of virgin forest. It is to be a model operation, using modern equipment and a logging road, about 30 miles long which has recently been built to carry 30-ton trailer lorries to take the logs to the sawmill. A railway branch line is being built to assist in the operation and this will open up yet another 140,000 acres of mature timber.

Tao Yu-Tien, Director of the Taiwan Forestry Administration considers there is no danger of Taiwan ever suffering a timber shortage for it has still more than 7 million acres of untouched forest, and the cleared areas are being replanted at a rapid rate.

A loaded truck proceeding by cableway to the sub-station far below

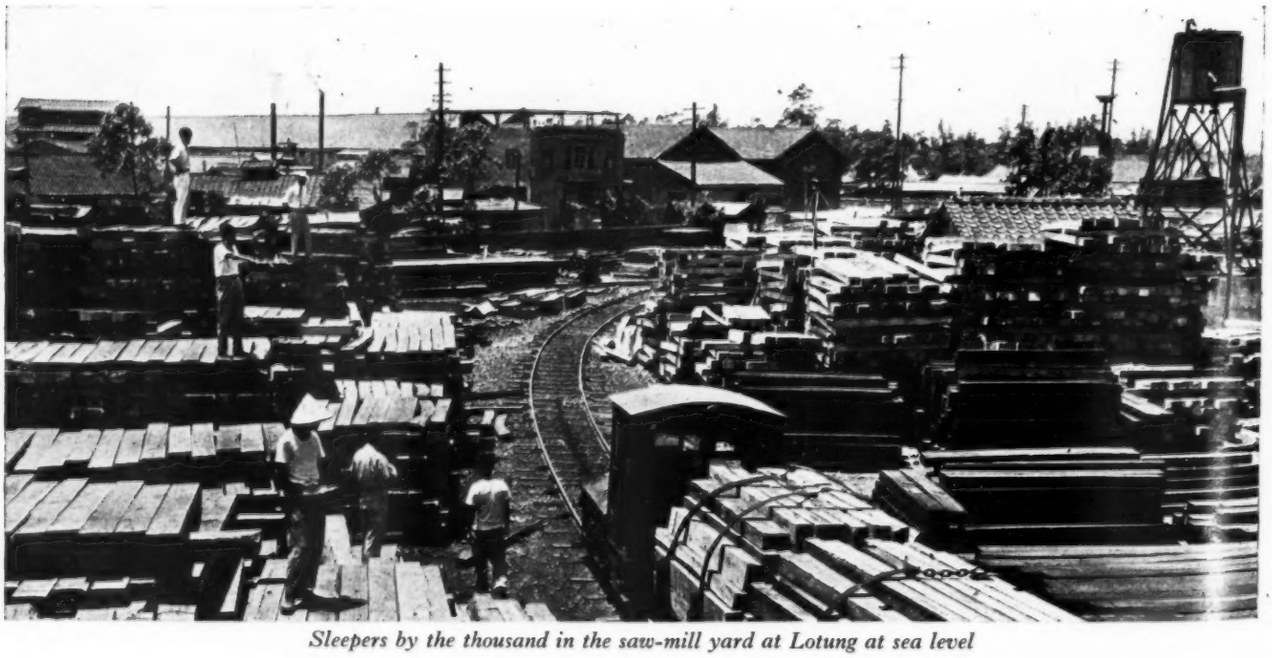
There are more than 100 nurseries where seedlings are being produced for reforestation needs—pine, Chinese fir and Japanese fir. Each year some 70,000 acres are restored, while some 25,000 acres only are being felled. As a result, where there was once a five-year gap between cutting and reforestation, this has now been reduced to two years.

Mechanisation in Britain

Mr. Harold Collison, General Secretary, National Union of Agricultural Workers, speaking at Wolverhampton recently, stated that over the past 11 years net output in the farming industry has increased by 29%, and net output per worker by 70%.

The agricultural worker in Britain today has to operate, and often maintain, a formidable mass of machinery. It is not always realised that there are now nearly 4½ million tractors and other machines, power units and implements, on farms in England and Wales; in other words, 11 items for every regular male worker.

The farmers who make progress will be those who realise that work study, and other productivity techniques, are in the end dependent on the co-operation and calibre of their workers, and the ones who will make the most progress will be those who not only recognise this, but are prepared and anxious to give workers their just reward.



Sleepers by the thousand in the saw-mill yard at Lotung at sea level

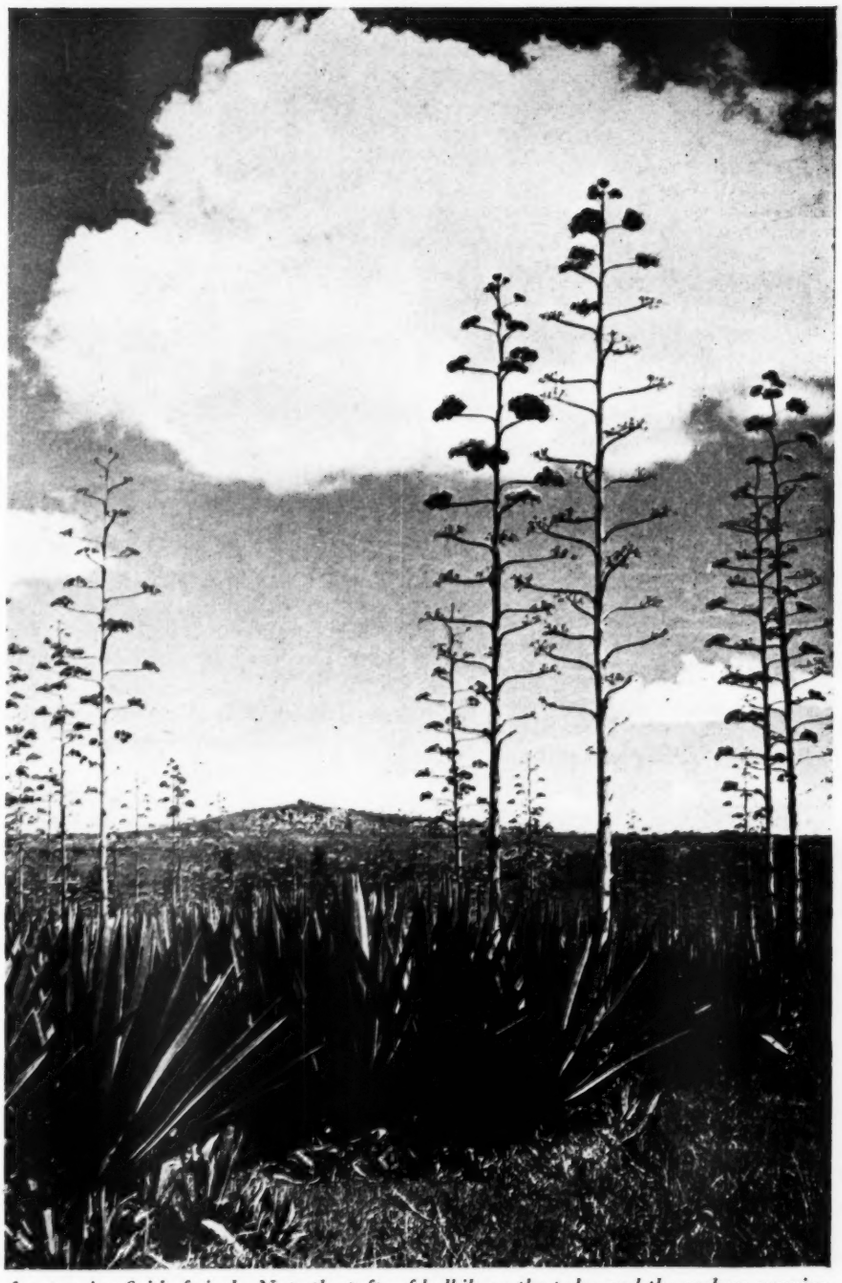
Sisal

A. E. HAARER, F.L.S.

Sisal hemp is obtained from a perennial stemless plant which was originally a native of Central America and has since been introduced into East Africa, Mauritius, West Indies, East Indies and the Republic of the Philippines.

SISAL fibre is obtained from the leaf of a monocotyledonous plant, *Agave sisalana*, which for many years the authorities at Kew have placed within the natural order Agavales and the family *Agavaceae*.

As with most species, there may be several forms deviating from the type, but the form of sisal grown in East Africa is that which was selected as being the best in Mexico. Plants were taken to Florida, whence sets were eventually imported into German East Africa, now Tanganyika Territory, by Hindorf. Propagation by vegetative means has preserved the form and purity of the plant and all the fields in East Africa are today of the same kind.



A ratooning field of sisal. Note the tufts of bulbils on the poles and the suckers growing at the base of each plant

The plant

The plant is composed of a short stunted stem from which the leaves spring immediately above the soil in a close spiral or whorl, the central leaves enclosing the bud in a tight pillar and unfolding one by one. The leaves, sword-like in shape, grow outwards rigidly of varying length according to their age, the age of the plant and the environment. Unlike henequen, there are no thorns along the margins of the leaves, only a strong thorn or spike at the tip of each leaf. When many of the leaves have been cut towards the end of the plant's life the bole or short stem looks not unlike a giant pine-apple.

If the leaves are not cut, as in a state of nature, the plant matures earlier because of the food constantly manufactured by the leaves towards the one great purpose, *i.e.* the production of the flowering stem and hence the reproduction of its species.

Towards the end of the fourth or fifth year the flowering stem, which in youth resembles a giant asparagus tip, grows out from the centre of the leaves and becomes a tall pole having horizontal branches at the top rather like a telegraph pole. On these branches flowers appear, but seldom set seed. Instead, numerous buds called ' bulbils ' appear, growing out and clustering from the flower branches, and these eventually shower upon the ground to take root and become new plants.

After poling, the mother plant dies, though a number of suckers have by this time surrounded it and grown up from the root stock, so that in time the surrounding ground can become a forest of spiky leaves. Naturally in such cases the leaves are smaller and the fibre of poorer quality. It will be understood, therefore, that sisal can be propagated in two ways: from the bulbils or from the suckers.

Environment

Sisal prefers a sandy or loamy soil, neutral, fertile and well drained. The plant is capable of resisting drought and prefers semi-arid conditions. This does not mean to say that sisal does not require good rains and sufficient

moisture; the rainfall should be between 35 and 50 in. per annum. In East Africa this rainfall usually takes place in either one big rainy season lasting about four months or two seasons – the big rains and the short rains, when the big rains fall from February onwards for a period of three or four months and the short rains fall in the autumn.

Between the rains the weather can be very dry, the temperatures high and the light intense. In such country the natural vegetation is that found in semi-arid country; sometimes a reedy grass savannah with thorn trees, giving the country a park-like effect; sometimes a thick thorny bush.

Drought slows up growth and tends to produce short leaves, whereas good rains and a certain amount of humidity, *i.e.* if a plantation is sited near the sea or on the wetter side of a range of hills, produce longer leaves, quicker growth and naturally a higher quality fibre.

Sisal cannot stand conditions that are too wet, leading to a saturated soil, for then the whole plant may turn yellow and give every symptom of ill health. At the two permitted extremes of dry and wet there is a tendency for the percentage fibre content, weight for weight, to be greater under dry conditions than under wet.

Quality and quantity

The sisal planter aims at good average length leaves with a high fibre content. He wants quality plus quantity, and quantity is given by the number of leaves produced per plant and the rapidity with which the leaves mature. It is advantageous if cutting can begin early and if cutting can be prolonged before the plant is forced by nature into maturity.

Poling is delayed for the longest possible time by cutting, *i.e.* reducing the number of leaves in accordance with the best plan in relation to the environment. In other words, the plant must be allowed to retain a sufficient number of leaves for healthy growth, but not enough to permit the growth of the flowering stem too early. Cutting prolongs the life of the plant – that is, the time before it begins to ' pole ' – from a period of only four or five years to seven or eight years, and during this longer period of growth more leaves are formed than would otherwise be the case.

Over-cutting can be disastrous; under-cutting may result in just sufficient leaves forming to influence the plant to begin flowering. There are limits, of course, because the life and growth of the plant cannot be prolonged indefinitely. It is necessary to emphasise that such cultural matters depend on the environment.

Photo: Wigglesworth & Co. Ltd.

Overhead ropeway for transporting sisal from field to factory

Even growth

It is desirable for each plant in a field to mature at the same time so that every plant produces its quota of leaves at every cutting cycle. For the purpose of maintaining a high-quality grade, or standard quality grade, the leaves cut at each cycle should be as near as possible the same length and size. It is undesirable to have some plants in a row over-size, with intervening plants under-size.

This condition tends to be produced if a plantation is developed from suckers, unless great care is exercised in the selection of suckers of the same size and age of growth. Some planters prefer to use suckers because it is stated that growth in the beginning is more rapid; in other words, cutting may begin earlier.

For evenness nothing can beat propagation by the use of bulbils selected for their time of production and size and planted in a nursery where they can receive special care and treatment before they are of a size for planting out in the field.

When the ultimate time comes for planting out in the field care should be taken to select nursery plants of the same size. Any that are too large, or those that appear unthrifty, should be discarded.

Sufficient area

Those who grow sisal economically usually invest in large plantations which stretch over hill and dale almost as far as the eye can see. Modern decorticating machinery, together with power plant, brushing machines, presses and perhaps driers is heavy and expensive. The engineering staff must be capable and the factory staff skilled. If possible, a sisal fibre-producing factory should work day and night, operating in shifts.

For continuous night and day operation artificial driers are needed to dry the fibre and keep up with decortication, especially during spells of cloudy or wet weather, when the fibre cannot be sun dried.

It takes some experience and calculation to arrive at the acreage necessary to keep such a factory running at maximum capacity, because replanting must be considered after a period of years, when new blocks must be ready for cutting. It would be better to have a slightly larger area than seems necessary rather than one too small. In computing the planted area required, the soil, climatic and environmental conditions affecting the rate of growth and the leaf production rate must be considered.

Availability of water

Since sisal is grown in regions which might be called semi-arid, it is sometimes a problem to find the water necessary, not only for domestic purposes, but also for use in the factory to wash the fibre and to carry off the waste pulp. The estate is fortunate if it has a perennial river or stream nearby. Otherwise water must be pumped from wells, brought for long distances by pipeline or collected by the conservation of surface run-off in large artificial dams.

Lie of the land

It is not often possible to find a considerable acreage of land with desirable contours, but when a plantation is laid out one of the chief considerations must be how to get the heavy bundles of cut leaves from the field to the factory as economically as possible.

Most of the estates use narrow gauge railways, siting their factories at the lowest level so that the trains of trucks, filled with leaves, can be

transported by gravity down to the factory. Aerial ropeways with stages for transferring leaf from skips to trolley trucks can sometimes be used with advantage to transport the leaf across deep ravines, rivers or awkward contours. In many cases small diesel engines are used for drawing long lines of empty trucks uphill back to the field, but where there is no tsetse fly trained oxen, though slow, have usually been found more economical for this purpose.

The lie of the land should also be considered from the point of view of soil and water conservation, drainage and the general arrangement of the plantation.

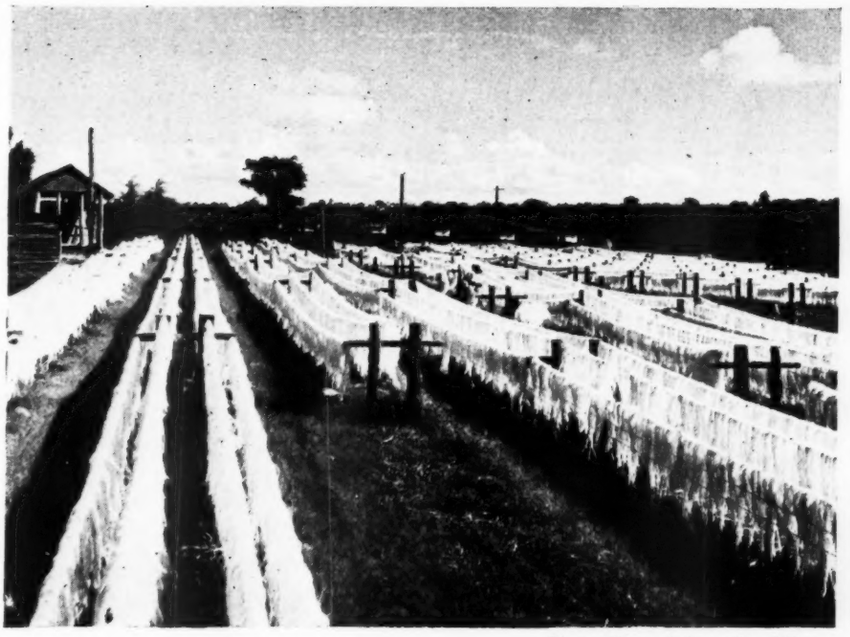


Photo: Kenya Information Office

Extracted sisal fibre being sun-dried in Kenya

Transport

Sisal fibre is produced in such quantity that it is necessary either to provide sufficient storage capacity or to get the product away for export almost as fast as it is produced. It does not take long for a large estate to produce sufficient bales to fill a train load of railway trucks. Because of this constant and heavy production it is vital for a plantation to be adjacent to road, rail or water transport for export. It often happens that a short branch railway is constructed from the nearest railway line to the factory store.

Labour

Although large estates are trying to mechanise most of the work, a great deal remains to be done by hand. The clearing of bush, the clearing of old planted areas, the maceration of residues, ploughing and cultivation can all be mechanised, as well as the transport and decortication of the leaves.

It is possible partially to mechanise the planting of young plants, but this is not wise because it is better to do the planting more carefully by hand. The mechanical cutting of the leaves in the field is also not yet feasible.

Labour is required for weeding a young plantation and when the weeds grow too tall, for cutting and bundling the leaves and placing them on trucks; also for handling the decorticated fibre in the factory, especially when the fibre is sun dried, and for odd jobs.

Soil and water conservation

When the land was first opened up consideration should have been given to the prevention of erosion; if this has been neglected, it can be introduced when replanting takes place. If the land is sloping, then broad-based, reverse-slope contour ridges should be constructed and properly graded so that run-off is checked and directed to flow sluggishly towards the natural drainage in the folds of the contours. This work is not only well worth doing, but these terraces can often be used as roadways, where sisal is not planted over them.

Planting

Spacing depends on the environment and local practice. Close planting gives more fibre per acre up to a point, but it often makes weeding difficult in the beginning. Some planters prefer square planting so that every plant is placed the same distance apart; others like to plant two rows close together with broader spaces intervening. If alternate close-row planting is adopted, then the planting should follow the contours as far as is possible to help prevent erosion.

Cutting begins when a sufficient number of the first leaves are mature, and the earliness of cutting and the subsequent cutting cycles must depend upon the environment and local growth. It is not possible to lay down any general rules. There is, however, one guiding practice: that at each cutting cycle at least 30 leaves should be left on each plant which have unfolded from the central pillar-like bud. Only when a plantation is being cut to death at the end of its life should all the unfolded expanded leaves be cut.

Weed control

During the preparation of land, couch grass and other noxious weeds must be entirely eliminated, not in a haphazard manner by ploughing and raking, but by the complete elimination of every piece which might grow again.

When once a plantation has developed the underground runners of such weeds, they will penetrate the roots of the sisal and will spread in ever-widening patches until whole blocks are infested. Their presence will depress the health of the sisal, shorten the leaves, diminish their number, and render the land almost useless for replanting, except at considerable expense. Chemical weed-killers can never be satisfactory among planted sisal. Their best use is by repeated applications to cleared ground until successive growths of the weed are entirely eliminated.

General weeding should be practised during the first year, for it has been proved that the first leaves grow better and can be cut and used if a plantation is clean-weeded in the beginning. Later when the sisal is

Cut leaf awaiting removal. This shows also the number of leaves cut and the number of leaves on the plant

fully established weeds do not affect growth to the same extent.

Pests and diseases

This is another matter which concerns the environment and the pests and diseases which are potential dangers. Managements should keep themselves informed of what to look for and enquire from the local agricultural research authorities regarding the best methods of control. Prompt action is important and the necessary pesticides and fungicides should be available in store with equipment and men trained in their proper use.

Maintenance of fertility

Fertility does not alone depend on the nutritive values of the soil, which might be well maintained by the regular addition of chemical manures. But no amount of chemical manure can maintain the physical nature of the soil, its texture, its ' good heart '.

In time the soil can become physically inert, almost incapable of absorbing moisture into the subsoil and maintaining life. In other words, it can assume the properties of a desert without fertility. Deserts can produce an abundant growth when moisture is applied, but with an inert desiccated soil nothing can bring it back into a desirable condition except an abundant supply of organic material, which is generally impossible for a vast acreage.

To maintain a proper physical structure and fertility, the soil should be rested, and the best method of supplying it with organic material is to sow successive crops of, say, sun-hemp or cowpeas and plough these in just before the seed pods are ripe. Resting will do something towards helping the soil to regain its vital structure, but it should be shaded from the sun and protected from lashing raindrops.

Fallowing under grass for a period of years is the recognised procedure in temperate climates, but it is hard to find a grass in a region where sisal prospers which can be handled in a similar fashion. The grass must be of a kind of which ample seed is procurable, which will germinate in a semi-arid region without shade, which will produce a close mat of growth upon the soil and will not persist as a weed when it is ultimately ploughed in.

Since the soil must be rested and treated to maintain its structure and fertility, it is not wise to go on planting year after year nothing but sisal on the same land. Provision should be made not only to provide enough land to grow successive blocks of sisal to keep the factory in full production, but to have enough land in reserve so that block after block may be rested directly there is any sign of a reduction in fertility.

Man sows . . .

Produced by Kurt Muller for Farbenfabriken Bayer in Agfa colour and sound. Running time: 45 min.

The leading actors in this colourful film are the great and menacing army of pests which threaten our crops and our food supplies and the camera is used to good effect to show them at work in support of the idea that ' Man sows, but the pests take their share of the harvest '.

We see close-ups of the stars in action – the Colorado beetle making short work of the leaves of a potato plant, of the desert locust defoliating an orange grove, of the notorious boll weevil on cotton, of aphids injecting their poisons into the leaves and stems of plants. Then we are taken to the four corners of the earth to see Man doing battle with such crop-destroying pests. We see dusts being applied in the irrigated paddy fields of Japan to destroy stem borers, vineyards being sprayed on the slopes of Mount Etna in Sicily, battle being waged with the locusts in the citrus groves of Morocco, and lethal preparations being dropped from the air on to cotton in Mexico.

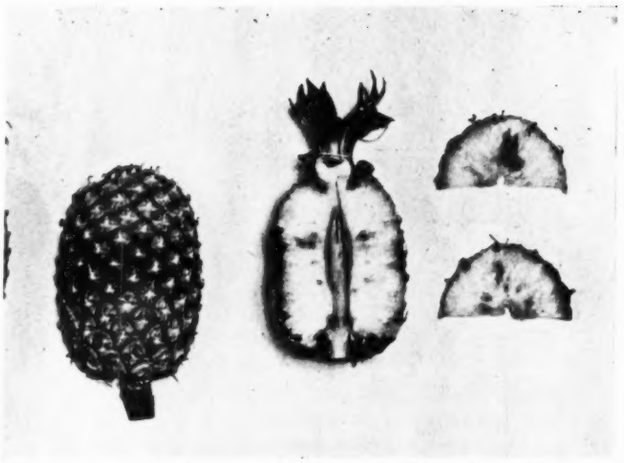
In the second part of the film we are shown the evolution of a crop-protecting chemical from the test tube to large-scale production in the factory.

Boron Deficiency

2—Recognition and Correction

P. A. ORAM, M.A., DIP.AGRIC. (CANTAB)

Part 1 dealt with the role of boron in plant nutrition, the importance of the element to world crops, and the losses incurred as a result of deficiency. The study of boron nutrition, as of most minor elements, is still in its infancy in many countries, and failure to recognise the symptoms of deficiency and the conditions under which it is most likely to occur may limit the effectiveness of crop improvement programmes in many under-developed countries.



Effect of boron deficiency on the pineapple. Note the untidy crown and cracked, brown core

NUMEROUS attempts have been made to correlate boron supply with factors such as soil texture and parent material, *p*H, organic matter content, and the supply of other minerals in soils or fertilisers. Unfortunately, soil boron content varies considerably and has proved difficult to relate to these factors, whilst plants differ both between and within species in their boron requirement. Certain factors of soil, climate and farming practice have, however, been shown to influence boron supply, of which the most important will now be discussed.

Soil Factors: Soluble borates are washed out rather easily from the soil and this is naturally worse in porous sandy soils, and in wet years. Scharrer *et al.* (1955) have shown that fixation of boron increases proportionately to clay content and *p*H, but more or less independently of humus content. However, the mechanism of fixation is not clear and the degree is likely to vary with the type of clay mineral.

Relations with Other Elements: Although uptake of other elements, particularly phosphorus, may be reduced under conditions of boron deficiency this probably results from impaired efficiency of the conductive tissues rather than from any direct relationships between the elements. As yet these are by no means clear, although Shcherbakov (1957) has suggested that boron is antagonistic to iron during early growth and Lundblad *et al.* (1956) suggest a possible correlation between boron and manganese. There is a well-established link with excess calcium, which reduces the availability of boron in the soil. Thus boron deficiency frequently follows liming of acid sandy soils and may occur in patches in many fields where heaps of lime have been left for some time on the ground, preparatory to spreading.

Climatic Factors: The effects of rainfall have already been mentioned and when a dry summer follows a wet winter the supply of boron, already depleted by leaching, is further restricted by lack of soil moisture. In addition, boron deficiency restricts root development and the plant is thus handicapped in obtaining the limited amount of available nutrients. This creates a vicious circle and if drought persists, the situation becomes progressively worse until the plant dies.

Farming Practice: Fertiliser dressings are tending to increase, and the heavier crops which result exhaust the reserves of minor elements in the soil; for example, there is a correlation between the principal areas of boron deficiency in the U.S. and those in which most major element fertiliser is applied.

It is sometimes alleged that fertilisers contain impurities which can supply sufficient trace elements. This is not true for boron, since synthetic fertilisers contain negligible quantities

Citrus tree suffering from boron deficiency. Left: before treatment; right: after treatment with borax. Note the die-back of the branches and the failure to form fruit due to deficiency of boron

and even nitrate of soda will not, at any economic rate of application, supply enough to correct a deficiency.

The same is largely true of organic matter and it has been computed by Steenbjerg (1955) that the boron content of 20 tons of stable manure and 20 tons of liquid manure is equivalent to only $1\frac{1}{4} - 1\frac{1}{2}$ lb. of borax. However, the effective level of application to prevent deficiency is at least 5 lb. of borax per acre and Buchner (1954) states that an average sugar beet crop removes the equivalent of $4 - 5\frac{1}{2}$ lb. of borax per acre, plus an additional loss by leaching equal to about half this amount.

Farmers should not be deterred from generous application of fertilisers by any danger of creating a shortage of trace elements, but they should however, be aware of this possibility and be prepared to take preventive measures when required.

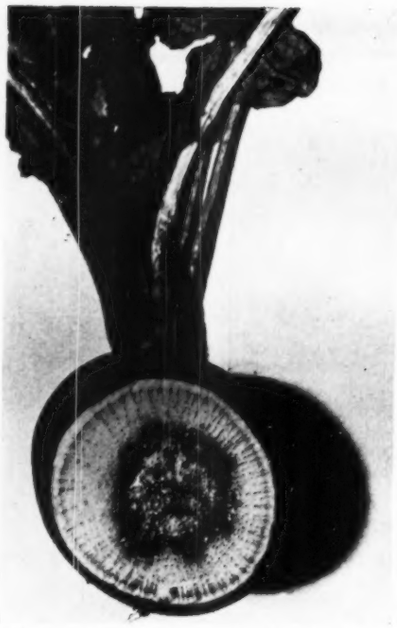
Diagnosis of boron deficiency

Deficiency could generally be diagnosed by routine analysis of soils and plants. This, however, is a counsel of perfection, since analysis as a method of forecasting nutrient requirements is still in its early stages of development and where such a service is available, routine tests normally cover only nitrogen, phosphate, potash and calcium. Such work is time-consuming and not many countries can afford the necessary staff, even where trained personnel are available. The best hope of preventing losses, due to boron deficiency, therefore lies in the early recognition of its symptoms and their correction by dressings of boron.

Deficiency symptoms

Symptoms have been described in detail for many crops and are now being recorded for others in which they were not previously recognised. Although descriptive literature is available, both from official bodies and private enterprise, experience shows that advisory officers cannot always recognise symptoms in the field. This is partly because they are not always clear in their early stages and may resemble damage from insects or fungi. Also multiple nutrient deficiencies may occur, especially in countries such as parts of Africa, where fertiliser use is very limited.

Broadly speaking, boron deficiency



'Brown heart' in swede due to boron deficiency. The same symptom is produced in turnips

symptoms may be grouped as follows:

General: Stunting and distortion of growth, death of growing points often accompanied by multiple branching at another point causing symptoms such as ' multiple crowns ' (beet) and ' palmilla ' (coffee).

Foliar symptoms: Dieback from tops of branches (citrus, apples, pears, citrus, and wattle); thickening and distortion of leaves (tobacco); sometimes chlorosis (alfalfa); or red and purple discoloration (clovers).

Stems: Thickening, cracking, and cork formation externally (celery). Internal breakdown and rotting of conducting tissues (cabbages and califlowers).

Reproduction: Reduction in the number of flowers produced and low pollen production resulting in failure to form seed or fruit (rape, linseed, lucerne, clovers, and grapes).

Fruit: Distortion and thickening of rind, internal and external cork formation, absence of pips, low sugar content (apples, grapes and pineapples).

Roots: Reduction in size of root system, internal rotting of storage organs; heart rot (sugar beet); brown heart (swedes and turnips).

Soil testing

In case of doubt laboratory tests of soil or plants are always desirable. Soil testing is complicated by the fact that boron content may vary greatly within quite a small area and the difference between deficient and sufficient levels may be small. For example, Dermott and Trinder (1946) reported the critical figures for Cumberland to be 0.22 p.p.m. and 0.38 p.p.m., respectively. Studies by Smith and Anderson (1955) in south-east Scotland showed that the minimum level of available boron to give sound root crops was 0.7 p.p.m. on medium and heavy soils and at least 1 p.p.m. on sandy soils, and that the available boron differed according to whether samples were taken in spring or autumn.

Since these two districts are quite close geographically the results suggest that attempts to forecast the likelihood of deficiency from soil sampling will prove difficult since ' normal ' levels established in one area may well not apply to a neighbouring one.

Tissue testing

Studies on the analysis of plant tissue have suggested that this is a more reliable diagnostic method than soil testing, but it is essential to establish the organs which give the most reliable results and the best age at which to take samples. Unless sampling methods are standardised on such a basis, wide fluctuations in results may be expected. It is also necessary to recognise the existence of variations in boron content between species and varieties and these may have to be established as a guide to recommendations.

Chemical tests for boron in soils and plants are generally based on colorimetric methods using reagents such as quinalizarin, carminic acid, curcurmin or 1-1 dianthrimide. These require a qualified chemist with an adequate laboratory and, by their nature, demand considerable care and precision. Comparative studies – Brown, 1958 – suggest that any of the methods mentioned is adequate and reliable, provided the necessary care is taken and contamination with external boron from glass or other sources is excluded.

Attempts to develop more convenient methods have included the use of an indicator plant, *Trandescantia fluminesis*, and micro-biological assay using *Penicillium chrysogenum*.

Empirical applications

Nevertheless no widely applicable ' spot ' test for boron has yet been devised and for this reason advisory officers in countries with limited laboratory facilities may find difficulty in confirming a suspected deficiency. In these circumstances it is probably best to try an application of borax to the soil or to the foliage followed by

Boron deficiency in tobacco induced by liming. Left: normal plant; centre: 1 ton of chalk; right: 2 tons of chalk per acre. Note distortion and thickening of leaves, shortened internodes and suppression of flowering

observation to see if the condition improves.

Generally speaking, spray application is likely to produce the most rapid recovery. Where a complex of nutrient deficiencies is suspected or where the symptoms in the crop cannot be clearly identified, the better method is to grow plants in pots containing the soil in question and to apply a method such as that devised by Webb (1957) whereby elements are omitted one by one from an otherwise complete nutrient solution until the critical factor is discovered by a process of elimination.

Correction of boron deficiency

Once boron deficiency has been confirmed, corrective measures should be adopted immediately, and these are not difficult, for boron can be applied either directly to the soil in the form of borax or boric acid, or combined with ordinary fertilisers. The latter vary according to the fertiliser industry of a country, but may be in the form of boronated superphosphate, boronated basic slag, boronated calcium nitrate, or boronated compounds, often of a type high in potash intended for use on sugar beet.

Since these are formulated by precise methods the danger of overdressing and thus causing toxicity is much less than where a boron-containing material is applied alone, unless the latter is very carefully mixed with sand or some other 'filler'. The combination of boron with ordinary fertiliser also saves an operation and this normally covers any slight addition to the cost of the fertiliser.

Studies by Wear *et al.* (1956) show that even the heavy dressings current in the U.S.A. are tolerated by most crops and have insignificant residual effects. The rates recommended in most countries vary from 10 – 20 lb. borax* or equivalent per acre; and provided that excessive applications and sensitive crops are avoided, fear of toxicity is unjustified. It should not mislead advisory officers, where boron is needed to prevent deficiency, into recommending rates too low to be effective, since this will only destroy confidence in remedial measures.

A recent development – Hubbard *et al.*, 1957 – has been the production of glass-like materials known as 'frits', often containing other minor elements besides boron. Owing to their slow solubility it has been suggested that these might be incorporated in all fertilisers as a routine precautionary measure without any danger of toxicity to sensitive crops. They might also be useful for perennials for which a steady but not necessarily rapid rate of release of nutrients is desirable. At the moment however they are an expensive source of boron, but investigations in progress on other and cheaper, slowly-soluble forms of boron may eventually lead to their more widespread adoption for the correction of boron deficiency.

* 1 lb. boron = 8.8 lb. of borax

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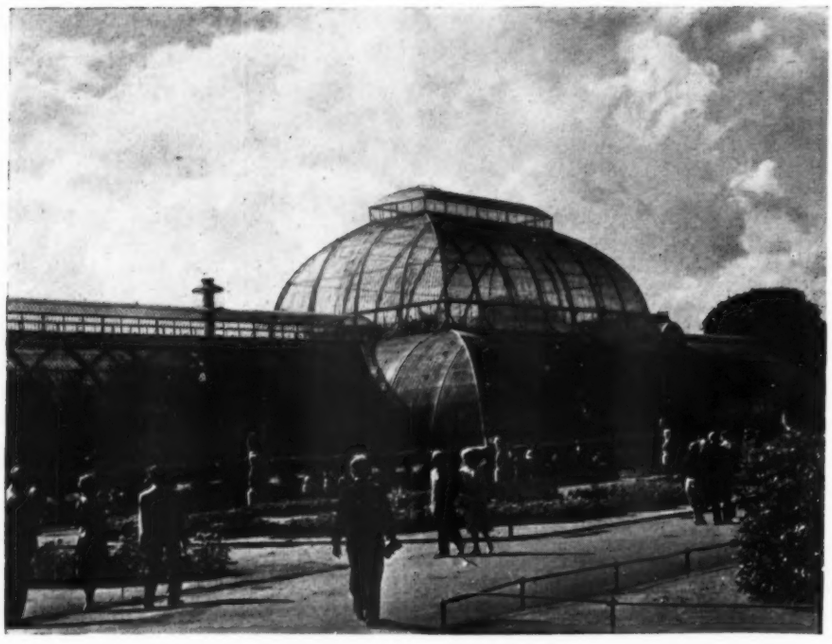
A Correction

The Cultivation of Citrus—3

PROF. H. D. CHAPMAN

Owing to a printers' error, the picture on page 255 of the July issue, showing leaf patterns produced with increasing deficiency of iron – from left to right, was printed upside down.

Two Hundred Years at Kew



The Great Palm House at Kew contains many species of palms, tropical trees and exotic plants growing in artificially created tropical conditions

THE garden of Kew House in 1759 bore little resemblance to the Kew Gardens whose bicentenary is being observed this year. The property – the house with its garden and parkland – had been taken on a long lease by Frederick, Prince of Wales, and thither in 1737 he had brought his wife, Augusta, Princess of Saxe-Gotha. There they lived at a convenient distance from the Court of his father, King George II, with whom they were rarely on speaking terms. The Prince of Wales took some interest in the garden and was at pains to have expert advice on its layout, but any ambitious plans he may have had for it were ended by his early death in 1751. The widowed Princess stayed on at Kew and in 1759 she decided on extensive alterations to the garden.

She engaged a landscape architect, Sir William Chambers, to redesign the property in the fashionable mode and to include space for a botanic garden, for the planting of which she employed William Aiton, a Scots gardener trained at the Physic Garden in Chelsea. By their efforts there soon came into being not only the Botanic or 'Exotick' Garden, but also the Great Stove (the largest heated greenhouse yet built), the Orangery and, in the more extensive pleasure grounds, a pagoda, various temples and other conceits.

In finding plants for the garden, Princess Augusta was much helped by the third Earl of Bute, a keen horticulturist, by whose assiduity plants were collected (in words of Chambers') ' from every Part of the Globe without any regard to Expence ', so that it was soon to be reckoned ' the amplest and best Collection of Plants in Europe '.

Widening outlook

King George III shared his mother's enthusiasm for the garden and on her death in 1772 he bought the property and extended its bounds. He found a keen collaborator in Sir Joseph Banks, who, until his death in 1820, spared neither time nor energy in furthering His Majesty's Botanic Garden. Banks had sailed round the world with Captain Cook on his first voyage, and had been much impressed by the potentialities of the new lands he had seen.

In his plans for the garden he proposed that it should not be just a pleasant place where visitors might be entertained by the sight of strange plants from abroad, but that it should be a centre where plant resources of the world should be studied and become known so that they might be put to best use for man's benefit. It was Banks who arranged that men trained at Kew should be sent to distant lands to collect and send back plants, and to the same end he corresponded with men whose vocations took them overseas, naval officers, merchants, doctors and travellers and encouraged them to send plants for the garden at Kew.

Kew for the nation

Banks' vision of what Kew should be was carried a stage further in the report of a Commission appointed in 1838 to advise on the future of the gardens. It was recommended that, if the Royal house were prepared to relinquish ownership, the gardens should be taken over by the State and that stronger links should be forged between Kew and British overseas possessions.

In 1841 the Royal Botanic Gardens were reconstituted with William Hooker as first Director and with clear and well-defined functions: *To study and make known the plant resources of the world, to facilitate the exchange of plants and especially to supply useful plants to British territories overseas, and to train and send out men to promote the study and cultivation of plants.*

The record of how these three tasks have been carried out would fill a large volume. The main task has always been to study plants – to be able to distinguish each plant and give it a name, to learn where it grows and what it is good for. In the course of this work there has been brought together from all parts of the world an unrivalled collection of plants, some living, but many more permanently preserved in dried state.

This collection has been greatly used

in the preparation of floras, descriptive lists of plants occurring in different areas. Work of this kind, far from being completed, is proceeding more actively than ever before, and the year 1959 sees in preparation, or under revision, floras of East Africa, West Africa, Cyprus and Iraq, while assistance is being given with floras of the area of Central Africa, watered by the Zambesi, and of Malaysia.

Exchange of plants

The second branch of work, the exchange of plants, has some romantic appeal and is already well known. One of the earliest shipments of plants to go from Kew, in 1797, was addressed to the Grand Duchess of Russia, and in the following year there was sent, in care of a gardener, a supply of economic plants for the young colony of New South Wales. In 1805 and 1806 plants went to India and to China, and a year or two later, among useful plants for Jamaica and St. Vincent, were the *nutmeg* and the *clove*.

As interest in British colonial territories grew, so did the distribution of plants develop, and we read that in the years of 1876 and 1877 plants were shipped to West Africa, Java, Singapore, North Borneo, Australia, India, Ceylon and West Indies. The fate of many of these shipments has gone unrecorded, but now and again one can trace how profoundly they have influenced the course of events.

Sir Joseph Hooker, the second Director, when asked what had been the most important commercial activity of Kew, replied, ' Quite certainly the getting of *quinine* into India ', with the result that ' anyone can get at any post office a dose of pure quinine for a little less than a halfpenny '. This combined effort of the India Office and Kew to make available in Asia this drug plant from the Andes for use against malaria had an incalculable influence on the well-being of millions.

A later Director, if asked the same question, might well have referred to the seedlings of *Hevea rubber*, from seed collected in Brazil and grown at Kew, sent to Ceylon and Singapore in 1877. From these plants arose the great industry of the Far East which brought rubber as a common commodity into everyday life and made possible road transport in its present form.

Plant collectors abroad

But it is to the third of Kew's functions, the training of men in the knowledge and care of plants, that we would give special mention, a function which, though it has received less notice, has affected agricultural development in many lands.

The first plant collector, Francis Masson, was sent out from Kew as early as 1772, under instructions from Banks. A native of Aberdeen, he had worked at Kew for some time under William Aiton, and was appointed to go to the Cape of Good Hope for three years to collect seeds and plants for Kew. In this he was extremely successful, sending back many plants of ornamental value, some now common in our gardens. He subsequently travelled in Europe, the West Indies and Canada, where he died.

In the meantime several other collectors had gone out, among them a Kew gardener, David Nelson, ' one of the quietest fellows in nature ', who went as a botanist with Captain Cook's third voyage, which explored the South Pacific. More fortunate than his captain, Nelson returned successfully from this voyage and was soon appointed to sail with Captain Bligh in H.M.S. *Bounty* and to take charge of the *breadfruit trees* which that ship was to carry from the South Seas to the West Indies. The epic story of that voyage and its mutiny needs no recalling. Faithful to the captain, Nelson shared with the loyal members of the crew the privations of the captain's boat, only to die a few days after reaching port at Timor, having earned Captain Bligh's tribute to his ' manly fortitude in our late disastrous circumstances '.

His task was taken up by another Kew man, Christopher Smith, one of two gardeners who accompanied Captain Bligh on his second voyage to Tahiti for breadfruit trees. This voyage was crowned with success and Smith not only saw the living cargo safely to the West Indies, but brought back a collection of West Indian plants to Kew. In 1794 he was appointed botanist at the East India Company's garden at Calcutta. During his service there he travelled to the Moluccas and collected plants of various *spices*, *nutmeg*, *clove* and other valuable plants, of which some thousands were shared between Penang, Calcutta, Madras, the Cape and Kew, so that a writer from Penang was able to boast, ' We are now become masters of every kind of spice plant valuable or uncommon '.

Such were the hazards of travel in those days that most of these early voyagers from Kew met an early death. Few lived to enjoy retirement as did George Caley, who, after strenuous service in New South Wales and St.

Australia House at Kew contains a collection of plants from the arid areas of Australia

Vincent, retired to Bayswater and there died, bequeathing an annuity to a cockatoo he had brought from Australia and freedom to a West Indian slave.

More typical was Allan Cunningham, who travelled in unknown parts of Australia with such disregard for comfort and safety that he was said to have ' worked himself to death '. A keen horticulturist as well as a great explorer, he carried seeds of useful plants on his journeys in unexplored country and is recorded as celebrating the King's birthday by planting acorns, peach and apricot stones and quince seeds.

Aid to new Botanic Gardens

During this period of active botanical exploration, botanic gardens had been established in several colonial territories. In St. Vincent a garden was started in 1764 and others followed in Jamaica, Madras and Calcutta, Ceylon, Singapore and elsewhere. Trained gardeners for these places were commonly sought from Kew and many Kew men took posts abroad. In 1870 the Director was able to say that over 30 former employees of Kew were now working in India alone; in 1906 that over 70 were employed overseas. Such men from Kew normally kept in touch with the mother institution and there was a constant exchange of plants.

The Director of Kew had thus much to do with the development of agricultural resources in these places, and fortunate it was that Kew had directors who were so keenly alive to these responsibilities as the Hookers, father and son, and their successor, W. T. Thiselton-Dyer. Associated with him was Daniel Morris, who, as Assistant Director from 1886 to 1898, devoted his great energy and ability to agricultural development overseas and left Kew to become Imperial Commissioner of Agriculture in the West Indies.

Cocoa plants from the quarantine house at Kew being packed into a sealed case for shipment overseas

Kew acts as a clearing house for the transfer of plants from one country to another. Here are to be seen young cocoa and banana plants

The position today

The early years of the present century saw the establishment of Departments of Agriculture in most of the British colonies, designed to assist and encourage the agricultural industries on which the developing colonies were increasingly to depend. These departments of government, while taking over some of the functions of the earlier botanic gardens, were organised to work on a wider field, including such subjects as agronomy, soil science, plant pathology, veterinary science and produce marketing. They looked increasingly to the Colonial Office for guidance and for recruits to fill their posts and the direct influence of Kew on agricultural policy overseas became correspondingly less. As the colonies one by one come of age and govern themselves a new relationship emerges wherein Kew, though no less ready to help, can only proffer assistance to the extent that this is sought.

Nevertheless, through its training of student gardeners, many of whom still find employment abroad, and some of whom come for instruction from overseas countries, Kew continues to further the cause of horticulture in many lands. The address list of the Kew Guild, the association of past and present employees of Kew, reads like a world gazetteer, as they write from Argentina or Zanzibar, from Bermuda, Zaria, Pietermaritzburg and Secunderabad, from Napier, N.Z., and Valhalla, N.Y.

So on this two-hundredth anniversary, as we echo the motto of the Kew Guild, ' Floreat Kew – May Kew Flourish ' – we have in mind not only the Royal Gardens beside the Thames, but the loyal and devoted service which has been given in the past by men and women of Kew penetrating to the far ends of the earth, and which, we hope, may be no less exerted for good in the changing circumstances of the future.

Seventy years ago. The pioneer of rubber planting, Dr. H. N. Ridley, standing beside one of the original trees in the Botanic Gardens in Singapore

Today. A latex tapper in Malaya at work early in the morning. He shaves off a thin sliver of bark each day and the wound bleeds for about four hours

Pineapples in Malaya

The pineapple fields of Malaya became so overgrown with weeds during the war that at the close of hostilities the original 60,000 acres had shrunk to 3,000 acres. New plantings have since increased the acreage to 36,000 acres and the annual harvest is now worth $10 million, and in 1957 the exports amounted to 42,500 tons.

This is an all-Chinese industry; the Chinese-owned canneries receive their supplies of fruit from their own plantations and from smallholdings owned by Chinese growers, the latter representing two-fifths of the entire production of fruit.

Trouble has been developing in the industry in recent years and became serious in December because of labour unrest, out-of-date production methods and increased competition from other producing countries. By early December two of the five canneries in the Malayan Federation had shut down and the remaining three plants were limiting their packing to fruit from their own plantations.

Grower demand for higher raw fruit prices occurred at a time when their unwanted pineapples were ripening in the fields and heavy losses seemed probable if harvesting continued to be delayed. To provide employment for the 16,000 workers affected, the Government began a campaign to increase domestic consumption. The recently established Malayan Pineapple Industry Board also interceded and under an arranged settlement, canners agreed to pay the equivalent of $14.85 per ton to growers and an additional $1.65 per ton payment was also provided from a special pineapple tax fund, bringing the total grower's price to $16.50 per ton.

Cotton in the Sudan

Next to Egypt, the Sudan has the most extensive area under cotton in Africa. The crop is cultivated in six regions, Gezira, White Nile, Kordofan (Nuba Mountains), Zeidab, Gash/Kassala and Tokar. In the Gezira area cultivation and export of cotton are supervised by the Gezira Board and irrigated land is made available by the Government with the arrangement that 40% of the profits remain with the planter, 20% with the Gezira Board and 40% with the Government.

The northern regions suffer from drought, whilst parts of the south have a rich vegetation. The climate is characterised by three periods: a cool and dry period from October to March, a hot and dry period from March to June, and the summer rains from June to September.

Where there are no reservoirs, the planting cycle depends on the flow of the Nile in spring. Where artificial irrigation is available, the land is flooded early in July. Sowing takes place in mid-August, and from then until blossom time in October/November the area is irrigated about 15 times, depending on the weather. The total length of the irrigation system is about 3,800 miles.

In the Sudan cotton does not ripen as quickly as in other countries, due to the climatic and soil conditions. Whilst two or three pickings are sufficient in most cotton-growing countries, eight to 10 pickings are necessary in the Sudan, but the fields must be cleared by 1 May so that the cotton pests can be controlled.

Most of the cotton cultivated in the Sudan is of the Egyptian long-fibre (' Sakel ' and ' Lambert ') varieties, with strict control into six standards of quality.

Tasmanian Farming

TASMANIA has a typically insular climate freed from extreme temperatures. It lies in the region of winter rains, but a considerable portion of the annual rain falls outside the winter months. In this respect the rainfall is similar to that in parts of Britain, South America and New Zealand. Such climatic conditions give long growing seasons and at the same time avoid the necessity of housing stock during the winter months.

To appreciate the significance of the agricultural developments in Tasmania one must look back over the last quarter of a century to the time when the occupied land was in a state of low fertility. In the early 30s Tasmania's main lines of production were potatoes for the Sydney market and oats grown for the production of chaff, the majority of which was sent away to other parts of Australia as horse fodder.

Tasmania has been called the 'Apple Isle' because of the large quantities of high-grade apples it produces. But apples are only one of the many products of this State which, in recent years, has paid increasing attention to the development of its grasslands, resulting in increased livestock production.

Cumulative nutrient deficiencies

Continuation of cropping, often without rotation, had reduced the once fertile soils of the State to a low standard of production. The restoration of fertility was essential before cropping could become profitable and this was brought about by a programme of grassland improvement and establishment.

The use of fertilisers has doubled during the last 25 years and developments in the use of trace elements have been important factors influencing increased production.

At that time certain areas were used for carrying sheep for wool production, but improved pastures meant an expansion in beef, lamb and dairy production. Thus Tasmania, with an increasing population, changed from an importing State to an exporting one in a comparatively short time.

Sheep farming

The sheep population of Tasmania has grown from 2,182,000 in 1951 to nearly 3 million today. Wool production over the same period increased from approximately 17 million lb. to approximately 29 million lb and with the increased area sown to pasture in recent years the supply of fat lambs has now exceeded the local demand and the export figure now exceeds 100,000 carcases annually.

In the mixed-farming districts fat lamb raising is usually carried on together with other branches of production. For example, on the north-west coast fat lamb production is associated with dairying and in the southern districts, where the average rainfall is lower, fat lamb production is associated with the growing of cereal and pulse crops. A large number of fat lambs are produced on mixed farms with flocks as small as 200–300 ewes.

Dairying

The dairying industry is concentrated mainly on the north-west coast, on King Island (situated off the north-west coast), in the north-east and, to a lesser degree, in the southern districts of Tasmania.

Here again, as was the case with sheep, there has not only been an increase in the total number of livestock carried, but a great increase in average yield per head. The cow population rose from 92,000 in 1951 to over 120,000 at the present day; at the same time, the total milk production increased from approximately 40 million gal. to over 65 million gal. The carrying capacity of good dairy farms ranges from one cow to the acre on well-developed swamp lands in the far north-west to one cow on 2 to 3 acres in the undulating basaltic country suited to mixed farming.

The bulk of the production is used for butter manufacture, but whole milk is in ample supply for city and town requirements. Cheese is also made, but on a limited scale.

Hop picking in New Norfolk, Tasmania

Pig Farming

Pig raising is usually an adjunct to dairying and in recent years the pig population has increased and there has been a marked improvement in the quality of the meat.

The indoor or permanent sty system has been largely superseded by a combination of the open-air system for breeding, rearing and growing in conjunction with topping off in a fattening house for the final few weeks. Circular farrowing pens have recently been introduced and the mortality of piglets reduced by the use of infra-red lights.

Beef cattle

From slightly less than 115,000 head of beef cattle in 1951 it has grown to nearly 160,000 head at the present time. Breeding, grazing and fattening are conducted in conjunction with practically every other form of production. Until recent years production was greatly influenced by seasonal conditions as cattle relied mainly on grass production. Now, however, more use is being made of hay and silage, which has resulted in more uniform feeding throughout the year. Housing of stock during winter is not necessary, but low winter temperatures in general make it desirable for the provision of shelter, usually in the form of wind-breaks.

Poultry

The most important recent development in the poultry industry is the commencement of a Poultry Stock Improvement Plan by the Department of Agriculture. A Random Sample Testing Centre has been established at the Cressy Research Farm to provide facilities in connection with an approved breeding scheme, by which samples of hatching eggs are accepted from approved commercial breeders and the chickens reared at the centre.

Improved pastures

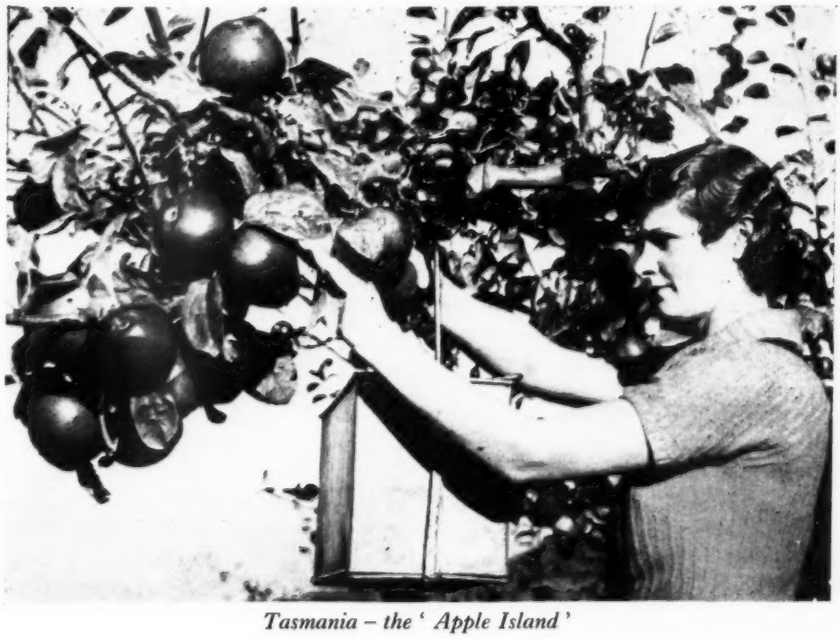
Great progress has been made in the past few years in the establishment of improved pastures. In fact, during the last 10 years the total area has more than doubled. At the present time the total stands at over $1\frac{1}{4}$ million acres, with more surplus fodder being available for conservation each year, so ensuring that stock is adequately fed throughout the year.

Hay and silage

The farmers now realise the value of conserved fodder for providing feed for periods of the year when pasture growth is insufficient to supply stock needs. As a result, the quantities of grass, hay and silage produced has increased rapidly over the past few years. Some of this expansion can be attributed to the improvements made in fodder conservation machinery. While the tractor and buck-rake are still most popular for silage making, forage harvesters are rapidly coming into the picture. Haymaking machinery has also improved considerably and the number of pick-up balers and hay presses in use has more than doubled since 1951.

Machinery and chemicals

In common with most other countries, the past few years have shown a great increase in the use of machinery on farms. While there is still a place for the horse on some properties, the draught horse population has been reduced to nearly half since 1951, while tractors have increased over the



Tasmania – the ' Apple Island '

same period to more than double.

Research and extension work

The Department of Agriculture provides technical services for the conduct of research and experimental work and extension services for the dissemination of technical findings. There are two research farms, one at Cressy in the North Midlands and the other at Elliott on the north-west coast. In addition, there is a potato station at Tewkesbury in the high country on the north-west coast.

Cereal crops

The *oat* is the most important cereal crop and, when the large area of oats grown for hay and forage is also considered, the influence of the crop on Tasmanian farm economy is apparent. In 1949–50 production amounted to 23,000 acres for grain, 40,000 acres for hay and about 50,000 acres for green fodder.

The Algerian oat is the principal autumn-sown variety. White Giant, Sir Douglas Haig and Tartarians are varieties used for spring sowing.

Yields of grain usually average from 25 to 35 bushels per acre and hay from 1½ to 2 tons. Crops exceeding 3 tons per acre are often obtained under favourable conditions.

The main *wheat*-growing areas are the Latrobe district in the north-west, the North Midlands and the south-east districts. Wheat is a crop of the mixed farms and is not the principal source of revenue. The average acreage for the 10 years ending 1948–49 was 6,200 and the area sown in 1949–50 was 5,470 acres. The two chief varieties are Braemar Velvet and Major. Pinnacle and Quadrat are becoming popular in north-west coastal areas. The average yield is approximately 21 bushels per acre, but on first quality land and under good management yields in excess of 40 bushels may be obtained.

Barley is grown principally in the northern and north-western regions. In 1949–50, 4,000 acres of English barley and 350 acres of Cape barley were sown. Three varieties are grown: Plumage Archer, Goldthorpe and Golden Archer. These produce an average yield of 26 bushels per acre. Cape barley is grown usually for green fodder and feed grain. It is a six-rowed type and relatively early maturing.

Fruit growing

The present area of *apple* trees is approximately 21,000 acres, production from which averaged about 4.6 million bushels of fruit actually marketed during the period 1934–39, with an additional quantity supplied to processing factories. The chief pome fruit producing districts are the Huon Valley, D'Entrecasteaux Channel, Tasman's Peninsula, Derwent Valley, Tamar Valley, Spreyton and Lilydale. In the 1951–52 season a total of 4.8 million bushels were produced.

Pears are grown throughout the entire fruit-growing areas, although the warmer districts appear more favourable to production. They are usually grown in conjunction with some other deciduous fruit trees. The total area is about 2,000 acres and production has increased from approximately 200,000 bushels in 1921 to over 500,000 at the present time.

Table 1

	Tons
Raspberries	2,585
Black currants	1,228
Loganberries	565
Strawberries	140
Gooseberries	120
Red currants	53

Plums are also grown to a limited extent in many fruit districts in conjunction with other deciduous fruits. The area under plums has gradually decreased from the maximum acreages which existed just after the war. The total area is now only about 500 acres, with an average production of about 2,000 tons annually, grown principally for processing.

The present production of *cherries* is insufficient to meet local demand. Production is risky in those districts where late frosts are experienced and where extremes of soil moisture may be experienced during the ripening season.

A herd of beef cattle in the lush pastures of a farm in the north-west of Tasmania

The *apricot* crop is almost wholly grown in the southern portion of the island, where the rainfall is 20–25 in. annually. The total area is approximately 900 acres, from which about 2,000 tons of fruit are harvested annually. Good crops average about 200 bushels per acre, although there is considerable variation. The bulk of the crop is used for processing purposes, such as canning and jam making. There is a limited acreage devoted to *peach* growing, which could be increased, as supply at present falls short of demand. For peach growing, conditions of soil and climate are similar to those of the apricot.

Berry fruits occupy an important place in Tasmanian horticulture. Production is confined largely to the foothills and valleys of the Huon district and Derwent Valley. Yields for the 1955–56 season are shown in Table 1.

Hops

Hop growing is confined to the southern districts on the deep alluvial loams of the river valleys, where facilities for irrigation exist. The approximate acreage in bearing in 1953 was 1,353 acres and the crop approxi-

Pick-up baler operating on a farm in the north-west of Tasmania

mately 3 million lb. of the dried product, an average yield of 2,210 lb. of dried hops per acre. This average is rather above normal average production per acre for the State, 2,000 lb. of dried hops per acre being considered a good average crop.

The principal varieties are the Whitebine Grape, Kent Golding, American Golden Cluster, Lates and Fuggles.

Vegetable growing

Fresh vegetable production for local consumption is chiefly confined to the market garden, where seasonal supplies of a wide range of vegetables are produced throughout the year. There has been a considerable increase during the post-war years in the area planted to vegetables for processing, particularly for the frozen vegetable trade. The *vegetable seed* industry in the north-west and north-east districts, produces mainly green peas, broad beans, brassicas, beet, parsnip, swedes, carrots, turnips and radish.

News from China

A possible hint of things to come was given in a lengthy article in the *People's Daily*, which likened China to a chess board. This pointed to the need for the various moves to be planned by a centralised leadership and the need to distinguish the really important projects and give them priority.

Although it is likely to be some time yet before the Chinese authorities can truthfully claim that the problems created by the 1958 'Great Leap Forward' campaign have been solved, there were some indications during March that order was being restored in some sectors of the economy. Deliveries of foodstuffs to the home market have continued to improve, although an upward trend in retail prices is still noticeable.

The Vice-Minister of Agriculture has stated that a summer wheat harvest, double last year's total, is possible this year, but that 80 days of hard work remain to be done. The three major jute-producing provinces – Chekiang, Kwangtung and Kiangsi – hope to double their output this year.

Investigation is to begin this year of a scheme to use the waters of the Yangtse River to irrigate land in the north and north-west of China by cutting a route from the south-west to these areas. Since the beginning of the spring afforestation campaign trees have been planted on 8 million ha. of land.

N.I.A.E.

Sir Eric Ashby, Vice-Chancellor of Queen's University, Belfast, Northern Ireland, is to be the chairman of the governing body of the new National Institute of Agricultural Engineering. The director is Mr. W. H. Cashmore, C.B.E., B.A., N.D.A.

The N.I.A.E., besides providing the unique service of independent, unbiased tests of machines and carrying out fundamental research on machines, materials of construction and new methods of agriculture, will now also be arranging courses of training in agricultural engineering.

A.E.A.

Speaking at the Annual General Meeting of the Agricultural Engineers' Association, Mr. L. C. Pearch, the new president, reminded us that it was an Englishman who, 250 years ago, produced the first practicable mechanical aids to farming. Today Britain still leads the world in farm mechanisation and is, in addition, the world's largest exporter of farm tractors and equipment.

On the home front, in face of a declining labour force, British farmers are producing an increasing amount of the food consumed in these islands. They achieve this only by increasing their efficiency, and this efficiency is based on the products of the agricultural engineering industry.

New Publications

Farm Management

Farm Organisation and Management, by Gordon Hayes. Pp. 333. London: Crosby Lockwood & Son Ltd. 1959. Price 25*s*.

This book has been designed for the student and for those who are or will be farming for a living. The treatment of the complex subject is as factual as possible and reference to theoretical economics is kept to the minimum.

The rapid advancement in recent years in production technique in farming, resulting from the work of the plant breeder, the chemist and the engineer, must be integrated with the business of farming. This is the province of the adviser and of the teacher in farm management and is the task undertaken in this book.

The Agricultural Acts of 1947 and 1948 in England and Scotland were designed to ensure that owners and occupiers of farm lands should fulfil their responsibilities in accordance with the rules of good husbandry. This calls for a reasonable standard of production, regarding both kind and quality, whilst keeping the unit in a condition to maintain such a standard in future. What greater, or fairer, demand could be made on any man occupying the land in these days of land shortage? This aspect of farm management is dealt with in the first part of the book and supplies much food for thought.

The second part considers the economics of farming, which are put out in a simple yet masterly form. Land tenure, labour utilisation, mechanisation and the raising of capital are discussed in a logical manner that should give confidence to the farmer starting up on his own account.

The next part discusses the problems of organisation which are met in different enterprises, such as crop production, milk and beef production, then with sheep, pigs and poultry. The effects of modern techniques of disease and weed control on rotational policy are described and the problem of fitting in cropping with that of livestock is developed. The muck cart is no longer indispensable to fertility as it was 50 years ago, and the more economical wild white clover ley, artificial fertilisers and lucerne have all had their recent effect on farm organisation.

TECHNICAL BOOKS

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The feeding costs in milk, beef and mutton production and in pig and poultry keeping are clearly set out and are based on up-to-date information.

Finally, Part IV deals with farm planning. Most farmers would certainly gain something by checking up their expense accounts against those given as examples in this section. Indeed, it is likely that the farmer of long experience would learn much by the perusal of the whole of this volume, for almost everything connected with the farm has changed over the past 20 years, and the statistics given, relating to pre-war and present-day conditions, will amaze even farmers who have worked through this revolutionary period.

C. R. HARLER

The Seychelles Annual

Pp. 48, cover and middle spread in four colours. Published on behalf of the Seychelles Government by the Letchworth Publishing Agency Ltd., Letchworth, Herts. Price 1*s*.

The first issue of this bright little annual, published primarily for the tourist trade, is packed with illustrations and interest.

In regard to agricultural affairs, there is a special article on the coconut industry of the Seychelles by Frank Cooke, another on the remarkable Coco-de-Mer, a useful map of the principal island of Mahé and a description of the climate and environment.

Other articles deal with other industries and tell how to reach these lovely islands, once remote, but now accessible on account of increased shipping facilities. In the foreword His Excellency the Governor states that the islands are free from hurricanes, dangerous reptiles and malaria.

A. E. HAARER

Other Publications

Publications also received include:

Annual Report of the West African Cocoa Research Institute, 1957–58. Published by the Crown Agents for Oversea Governments and Administrations, 4 Millbank, London, S.W.1. Price 5*s*.

The Spread of Virus Disease in Cocoa. By J. M. Thresh. West African Cocoa Research Institute Technical Bulletin No. 5. Published by the Crown Agents for Oversea Governments and Administrations, 4 Millbank, London, S.W.1. Price 2*s*. 6*d*.

Characteristics and Origins of Soils in the Coleraine District, Victoria. By G. Blackburn and T. I. Leslie. Soil Publication No. 12 of the Commonwealth Scientific and Industrial Research Organisation, Melbourne, Australia. 1958. Price not stated.

Report of the Possibilities of Growing Cocoa in the Protectorate of Nyasaland. By D. H. Urquhart, B.SC.(AGR.). Prepared for and published by Cadbury Brothers Ltd., Bournville, Worcs. Price 5*s*.

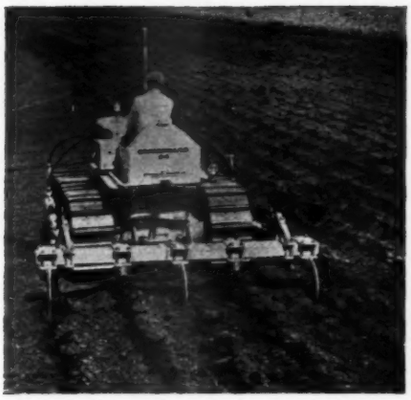
Record of the 1958 *Annual Convention of the British Wood Preserving Association*. Obtainable from the Secretary of the Association, 6 Southampton Place, London, W.C.1. Price 12*s*. 6*d*. to non-members.

Technical Data – Wheeled Tractors. By Ir. F. Coolman, assisted by H. B. Leeuwerke. Second revised edition. Publication No. 48, December 1958, of the Institut voor Landbouwtechniek en Rationalisatie, Wageningen, The Netherlands.

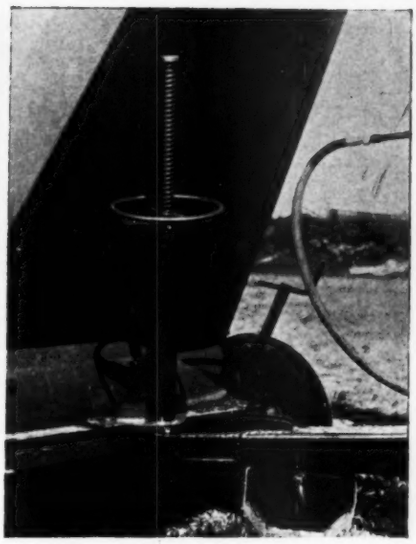
Ninth Session of the Conference, 2-23 November, 1957. Food and Agriculture Organisation of the United Nations, Rome, Italy, 1958. Price 16*s*. 3*d*.

Agricultural Statistics, 1956–57. *England and Wales*. Census of agricultural production for 1956–57, with prices and index numbers for 1955 and 1956. London, 1958. H.M.S.O., York House, Kingsway, London, W.C.2. Price 10*s*.

This new rear-mounted toolbar is raised and lowered by the hydraulic rams of the David Brown 30TD tractor



A Caterpillar D4 tractor with its toolbar, fitted with five chisels for breaking up hardpan formations



New screw-type hitch for the new H1 'Gloster' off-set forage harvester is manufactured by Bamfords

This Year's Royal

The first Country Meeting of the English Agricultural Society took place on seven acres of land at Oxford on Tuesday, 16 July 1839. This year's Show – occupying 143 acres – was the fourth to be held near this ancient university city and was the 111th in the history of the Royal Agricultural Society of England.

THE Show had something for everybody – magnificent displays of fruit, flowers and vegetables; 3,000 entries of pedigree cattle, sheep, pigs and poultry; all kinds of horses – draught, hunters and riding ponies; the story of wool from the sheep's back to the finished garment; and countless displays of rural arts and crafts. There were competitions for stock handlers and for tractor drivers; for blacksmiths and gatemakers; for the expert horseman and for amateur judges of stock.

There was an extensive woodlands and forestry section; an exhibition of farm buildings and equipment; for the vegetable and fruit grower, there was a display of machinery and equipment for the pre-packaging of their products; and for the planter, farmer and market gardener, there was the latest in agricultural machinery, seeds and supplies. The following is a very brief account of some of the exhibits that caught the eye:

A

The leading exhibit on the stand of *Allis-Chalmers (Great Britain) Ltd.* was a No. 7 side-delivery rake and tedder, which this company was showing for the first time. This machine has a raking width of 10 ft. and the spring-suspended reel is fitted with 128 detachable tines. There are adjustable levers for raising or lowering either end of the 10-ft. reel and an adjustment of the p.t.-o. makes it possible to change from side-raking to tedding. They were also showing their range of tractors, their gleaner combine harvesters and the model '60' all-crop harvester.

Automotive Products Co. Ltd. exhibited their range of components for tractors and agricultural machinery. These included the new Borg and Beck 10-in. integral main drive clutch and p.t.-o., which provides independent control of the main drive to the wheels and the p.t.-o.

B

A new introduction – the H1 'Gloster' forage harvester – was to be seen on the stand of *Bamfords Ltd.* This machine is an offset model giving a 40-in. cut and it is fitted with a new screw hitch for easy 1-man attachment or detachment of the trailer. There is also a new eye-type hitch for tractors fitted with automatic hitch assembly. Other recent introductions were the W1 'Wuffler' hay conditioner and aerator, their T1 single-row swathe turner and the D24 3-point linkage, tandem disk harrow, which has 24 disks and a working width of 7 ft. 7 in.

The following machines were exhibited by *Barford (Agricultural) Ltd.*: their tractor-towed, in-line, flail-type forage harvester; a rear-mounted, tractor-drawn ditch cleaner for cleaning up ditches and dykes from 3 ft. 6 in. to 16 ft. wide; the 'Atom 30' 2-wheeled horticultural tractor with improved plough and beam attachment; a 1.9-h.p. power scythe fitted with balloon-type wheels; two types of rotary mowers for controlling grass and undergrowth in orchards and on road verges; and also a tractor-mounted cement mixer and a 1-ton, 6-h.p. diesel dumper.

A. B. Blanch & Co. Ltd. had a remarkable range of their exhibits, including a working model of their 'Banger' automatic bird scarer, which gave out a loud detonation every five minutes with a special arrangement to stop and start again at predetermined times. Among a wide variety of agricultural machinery on show were two new introductions: the 'Superfurrow', a very sturdy plough for fitting to tractors with category 2 linkage, and the 'Hydrake', which can be used with category 1 and 2 tractors as a swath turner, a side-rake and a centre gatherer.

Pride of place on the stand of *Messrs. Bomford Bros. Ltd.* was given to their new 2-furrow reversible plough, reviewed in WORLD CROPS, 1958, **10,** 386. The interest shown in

the principle of deep skimming has led to the introduction of a 2-furrow right-hand plough for use with the *Ferguson* tractor, which incorporates the design features of the reversible plough. Also on show were the ' Warwick ' and standard hedgemakers and a selection from their ' Threadless ' sprayline overhead irrigation equipment.

Bomford & Evershed Ltd. were showing their power-dozer and rear grader and the ' Sapper ' ditcher.

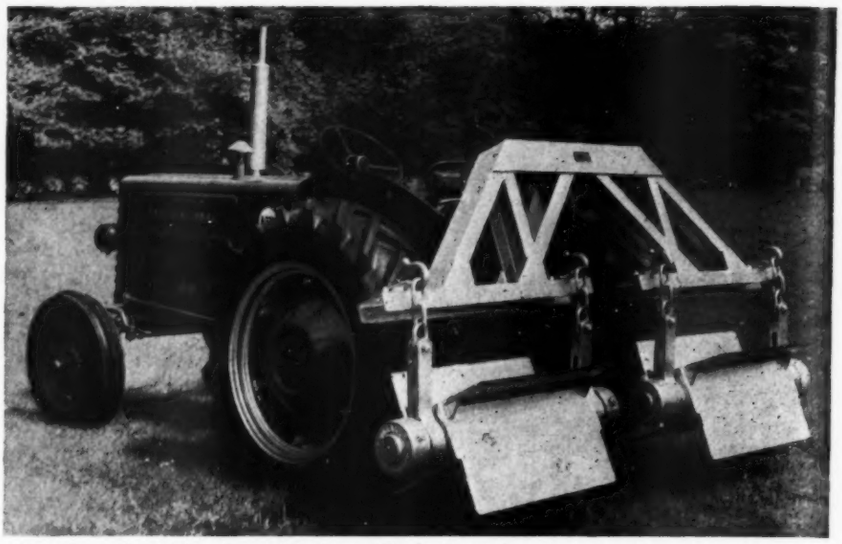
The *David Brown* stand provided the setting for a combined display of tractors and farm machinery in current production. The centre-piece was their new 42.5 h.p. ' 950 ' tractor (see WORLD CROPS, 1959, **10**, 155). Other new machines shown were the 'Albion Hurricane ' verge trimmer – a flail-type forage harvester, fitted with a new hydraulic pick-up hitch; the 'Albion ' pick-up baler with p.t.-o.-driven, side-delivery; and an hydraulically-operated tool-bar for crawler tractors, fitted with powerful ripper teeth for subsoiling.

Byron Machinery Ltd. were showing their belt conveyor, which has a new sprocket and chain drive working in circuit with a 26-ft. ' Byric ' auger elevator, which is able to handle even very wet grain due to the incorporation of a new patented device – the ' Contavane '. Besides being able to handle wet grain, this machine is also able to handle pelleted and other feeds.

C

' Big tracks for big jobs' was the theme of the *Caterpillar Tractor Co. Ltd.*, who showed bulldozers, scrapers and rippers in association with their powerful D4, D6 and D8 tractors. There was also a No. 933 traxcavator, a foreloader with a remarkable side-dumping bucket, which is hydraulically-controlled.

The conflict of opions between the advocates of organic and inorganic fertilisers appeared to have been resolved, for on the stand of *Chase Protected Cultivation Ltd.* there were mass displays of ' Sea Magic ' and ' Cofuna', both of which can be used with artificials, if so desired. The former is for use as a foliar spray and the latter is a bacterial manure, both provide the major plant nutrients as well as trace elements, while ' Sea Magic ' repels aphides, which are so often carriers of virus.



Holt 'Sugarland ' breaker with the saddle-back toolbar, carrying the two weedbreaker sections, in the raised position, as attached to an International Harvester tractor

The ' Hurricane ' knapsack power mistblower and duster, shown by *Cooper, Pegler & Co. Ltd.*, is for low volume spraying of highly concentrated insecticides and fungicides. Its conversion to a power duster took only a few minutes. Another new introduction was the ' Plafog ' sprayer for bush crops; it delivers a penetrating mist at pressures of up to 200 lb./sq. in. Maintenance is negligible because it has a metal piston with no piston leathers.

Of special interest to our overseas readers was the useful range of tyre, wheel and axle equipment, ranging from undercarriages for sugar cane carts to light barrow and special wheel units, to be seen on the stand of *J. W. & T. Connolly Ltd.* They also showed their standard rowcrop conversion set, another to give extra height and ground clearance and yet another with narrow section tyres, so that cultivation can be done at a late stage, without damage to the plants.

Grain conveyors, elevators, bins and silos, made from sheet steel, which had been rust-proofed by the hot-dip galvanising process, were exhibited by the *Crittall Mfg. Co. Ltd.* There was also one of their high-level, pre-storage bins and a gravity bin to hold four tons of pelletted poultry feed.

D

Two new machines were to be seen among the exhibits of *The Dorman Sprayer Co. Ltd.* With the new ' Osprey Ace ' mister-duster, it is possible to apply a wettable powder without pre-mixing, and to introduce a very small amount of a liquid into the dust stream, so as to create an artificial humidity in very dry conditions and thus ensure that the dust will adhere and will not be wasted. The other machine is the ' Plantector ' tractor-mounted crop duster. This is a 13-row machine with rates of application variable from 2½ to 30 lb. per acre.

Dow Agrochemicals Ltd. made their debut with a display of their three principal products—' Dowpon', the couch and perennial grass weedkiller, ' Etrolene ', a new systemic drug for killing warble flies in cattle, and ' Zoamix ', an anti-coccidal medicine for inclusion in poultry foods. The effect of ' Dowpon ' on the underground stems of couch was effectively demonstrated, as well as its non-toxic qualities to man and animals, and game and fish.

F

The stand of the *Ford Motor Co. Ltd.* covered an area of 24,000 sq. ft. and included a display of Fordson tractors and power-matched implements. There were nine ' Power Majors ', including a cut-away model, 15 ' Dextas ', a ' County ' crawler and a four-wheel drive tractor. In addition there were demonstrations, displays and film shows.

G

Two new tyres have been added to the *Goodyear* range – the ' Row Crop ',

a narrow-section rear tyre specially designed for row-crop operations, and the ' Super Rib ', a front tyre with a 3-rib tread.

H

The *Hayter* 6/14 can be attached to any make of tractor fitted with a rear p.t.-o. It is a grass cutter which is designed to follow closely the contours of the ground and gives a 6-ft. cut. Although capable of the heaviest type of grassland reclamation without choking or damage, the machine is best known for its use in pasture improvement with frequent usings. Other implements shown by this company were the self-propelled scythe, which gives a 26-in. cut, their hand-propelled model, the 24-in. motor scythe, and the domestic model, the 18-in. ' Hayterette '.

An implement of particular interest to overseas readers was the ' Sugarland ' breaker to be seen on the stand of the *Holt Weed Breaker Co.* The implement is designed for simultaneous 2-row weed control, trash chopping and cultivation in sugar-cane or any similar row crop with a row spacing of 4 ft. 6 in. The tractor straddles the row and carries a saddleback toolbar with two attached weed-breaker sections, each 28 in. wide and either weighing 700 lb. or 1,000 lb. each, according to requirements. These cylindrical sections are fitted with transverse knives.

I

The main feature on the *India Tyre* stand was the new ' Super-Grip ' tractor tyre for rear wheels, incorporating the India power curve tread, which has long curving bars to give positive forward traction over a greater working area and is particularly suitable for the higher h.p. tractors of today. The improved ' bite ' ensures that the extra power is fully utilised by reducing wheel spin and that the tractor is kept moving under all conditions. This company had a tyre for every kind of agricultural equipment.

K

Kent Engineering Co. Ltd. were showing three spraying machines: a tractor-mounted ' Powermist ' suitable for all crops, the tractor-mounted ' Conomist ' for ground crops and the ' Motoblo ' a shoulder - mounted, power-driven mistblower, dustblower or flame thrower. In addition, they showed the ' Motohak ', a 3.8-h.p. lightweight cultivator with plough and seed-sowing attachments, and a motorised chain saw, the ' Solosaw '.

The mechanised farm needs special equipment for handling livestock feed and produce. *Geo. W. King Ltd.* were showing their tubular steel cow stalls, calf, cow and bull pens, overhead carrying runways and cross-track turntables, pig pen panelling, broiler house fittings and a selection from their range of grain handling and storage equipment.

The motorised 'Solosaw' weighs only 26 lb. and develops 5.2 h.p.

L

The new ' Lodematic ' sack humpers and crate loaders were shown by *Lodematic Ltd.* They can be pushed like an ordinary barrow or hand truck and the sack humper has an automatic lift of up to 10 ft., according to requirements. After receiving the sack the platform rises and stops at any predetermined height; then after the bag has been removed it automatically descends. The dairy crate loader operates similarly, lifting batches of crates on or off lorries.

M

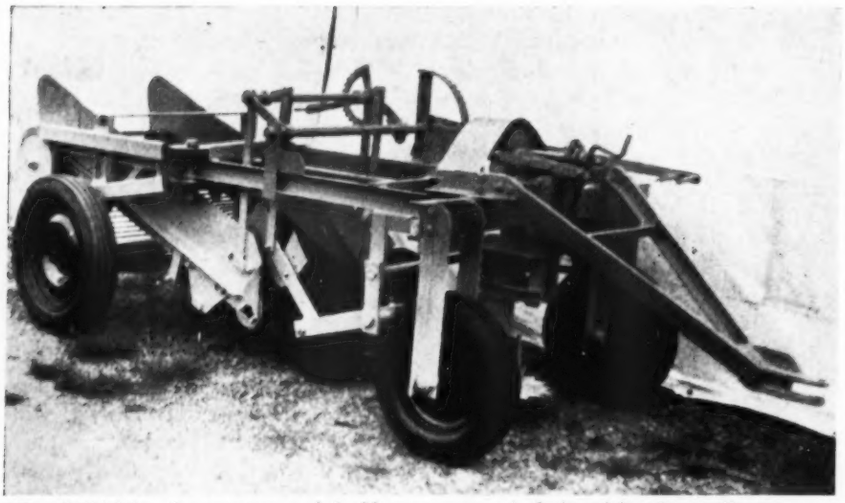
On their extensive stand *Massey-Ferguson* were displaying more than 50 different implements. There were tractors of two sizes, large and small combine harvesters, balers and foragers, two different types of planters, two loaders, two seed drills, three mowers and a wide range of cultivating equipment. There were high-clearance versions of both the ' 35 ' and the ' 65 ' tractors for row-crop operations. The centre of attraction, however, was the remarkable potato harvester which this company has just introduced.

There was a complete range of eight selective weedkillers by *May & Baker Ltd.* on their stand to meet all the requirements of modern agriculture, grassland management and forestry. There was also an interesting new fungicide, called ' Tubosan ', which is a dispersible powder containing ziram and copper, which it is claimed will give complete protection against potato blight.

For faster farming *Midland Industries Ltd.* were showing the full range of their front- and rear-mounted hydraulic loaders, including a new model for the *Fordson Major* with a greater lifting height than their standard model, F. Mk. III. Another new implement shown was a sturdy 9-tine cultivator with provision for both category 1 and 2 linkages. Other equipment on show included the Rivierre-Casalis baler, the MIL loader and buckrakes.

To rule out the necessity for excavating grain pits in ground where the water table is near the surface, *Mitchell, Colman & Co. Ltd.* had on display an above-ground self-emptying grain hopper and a short screw conveyor unit for insertion into the base of a silo to give a horizontal discharge. Two other new developments were the ' Tornado ' grain blower and a robust

The 'Lodematic' sack humper and lorry loader has an automatic lift of up to 10 ft.



'Turnhill' lifter for potatoes and double-row carrots is designed for the smaller growers

cutter and chopper, adaptable to the 3-point linkage and p.t.-o. driven.

N

Several recently introduced machines were included in the range of agricultural machinery arranged by *W. N. Nicholson & Sons Ltd.* There were tedders, rotary haymakers and swath turners, manure dispensers and fertiliser distributors, tractor-drawn cultivators and corrugated rollers.

P

A new 4-cylinder engine – the 'Four 270D' – which was exhibited together with other engines in the *Perkins* range, is the first direct-injection engine to be made by this company. Designed for farm tractors and combine harvesters, it is claimed to have a particularly low fuel consumption and to give easy starting in cold weather.

F. W. Pettit Ltd., who are specialists in trailers, had an impressive display of their tipping trailers of steel and hardwood construction. Their latest invention is a rear-door lifting device, which makes it possible for the trailer to be backed to the silage pit, the load to be deposited, and the tail door to be closed by an automatic locking device without the tractor driver having to leave his seat.

Messrs. Charles H. Pugh Ltd. were exhibiting a comprehensive range of their 'Atco' motor mowers, 'Atco-scythes' and Shanks gang mowers. There were two new models – a 14-in. motor mower and a 24-in. side-wheel model. Both have fan and cowl cooling and 4-stroke engines. There were also two interesting accessories – their wheeled carriers and a trailer seat attachment which reduces fatigue when the operator is mowing large areas.

R

Pride of place on the stand of *Ransomes, Sims & Jefferies Ltd.* was given to their 12-ft. cut self-propelled, tanker model, combine harvester, which had special inspection windows so that people could see the internal details. Another machine, which attracted attention, was the gravity-flow grain drier, fitted with oil-firing equipment and electric power. There was the usual show of tractor ploughs, including 1-, 2-, 3- and 4-furrow implements and two disk ploughs, one being a reversible model. Other implements shown were a rear-mounted mower, a potato digger, a sub-soiler, a tipping trailer and an ingenious vibro-hoe.

Root Harvesters Ltd. were exhibiting the new Continental type 'RB' root harvester together with the equipment for handling both carrots and potatoes, including a redesigned top cutter and a new bagging bulk loading, and hydraulically-operated bulk loading extensions. For the smaller growers, they had the 'Turnhill' root lifter, which incorporates some of the features of the Continental model. It is a semi-mounted unit for tractors with hydraulic linkage and p.t.-o. The new 'Todd' sugar-beet cleaner and loader has a high level agitated conveyor which shakes out the soil from the roots as they are loaded from the dump into the lorry. The 'Todd' down-the-row beet thinner was also shown.

Ruberoid roofing, shown in three weights, is an ideal material for farm buildings, both fixed and portable, and of every size. With this material it is also possible to use old and abandoned buildings to provide shelter for modern farm machinery instead of leaving it in the open. This company also showed various building materials, horticultural sundries and roof paints

S

Shell Chemical Company had arranged an impressive display of their two fertiliser products: 'Nitra-Shell' and 'Magnesium Nitra-Shell'—products of the new ammonia plant at Shellhaven-on-Thames. Details were given of the next National Grassland Demonstration which is being sponsored by this company in association with the Ministry of Agriculture and farming organisations. The provisional date is 8–9 June, 1960.

The tractor-drawn 'Stanhay' hay tedder discharges the grass as a fluffed swath without damaging the leaf

Simms Motor Units had on display a wide range of fuel injection equipment and a complete range of their electrical equipment, including dynamos, starters, head lamps, side lamps, tail and stop lamps and ploughing lamps. There was a hand-operated starter and turbochargers for diesel engines.

The complete range of 'Standen' implements and equipment were on show on the stand of *F. A. Standen & Sons Ltd.* These included an improved version of their sugar-beet harvester, Mk. II, which is now able to operate under the worst conditions; it is available with or without the attachment for saving the tops. Their carrot harvester will top, lift and clean the roots and is available with or with-

out an elevator. Their inter-row rotary hoe is offered with four cutting heads of various widths for weed elimination and cultivation between the rows of growing crops and there is a special model for strawberries. A haulm-cutting attachment is now provided for the ' Peter Standen ' potato digger.

The *Stanhay* hay tedder is a new tractor-drawn machine for the quick drying of the crop. The grass is gathered, carried over a rotating drum and discharged as a fluffed swath,

The 'Pixtone' will collect stones and rocks on cultivated land more easily and cheaply than by hand raking

without any damage or shattering of the leaf. Another new machine shown by this company was the Tapsell bale loader—a long-arm implement which will load bales up to seven tiers high on the following trailer. In addition to their land-wheel drive drills, they also had a new power-drive seed spacing drill, capable of working at 3 m.p.h., which is 1 m.p.h. faster.

The ' Pixtone ' seen on the stand of *Steel Fabricators (Cardiff) Ltd.*, is a new machine for picking up, carrying and dumping stones on land under cultivation. It is claimed that it will pick up four loads of stones and rock in one hour at a fraction of the cost of hand-raking. The ' Shawnee ' system for low-cost earth moving with low-level mounting makes it possible to utilise to the full the horse power of the tractor with extra safety. The mid-mounted Horndraulic loaders were shown as attached to various makes of tractors.

T

The name of *Taskers of Andover (1932) Ltd.* is associated with tipping trailers, farm wagons, tractor trailers and car trailers. This company exhibited a range of their vehicles, together with a selection of agricultural implements, including the Paterson silage buckrake, the Paterson earth-scoop and the Paterson grader blade for forming roads and ditches and for land levelling. The Arthur rotary slasher, also shown, will cut an 8-ft. swathe through scrub, bracken, gorse or secondary jungle.

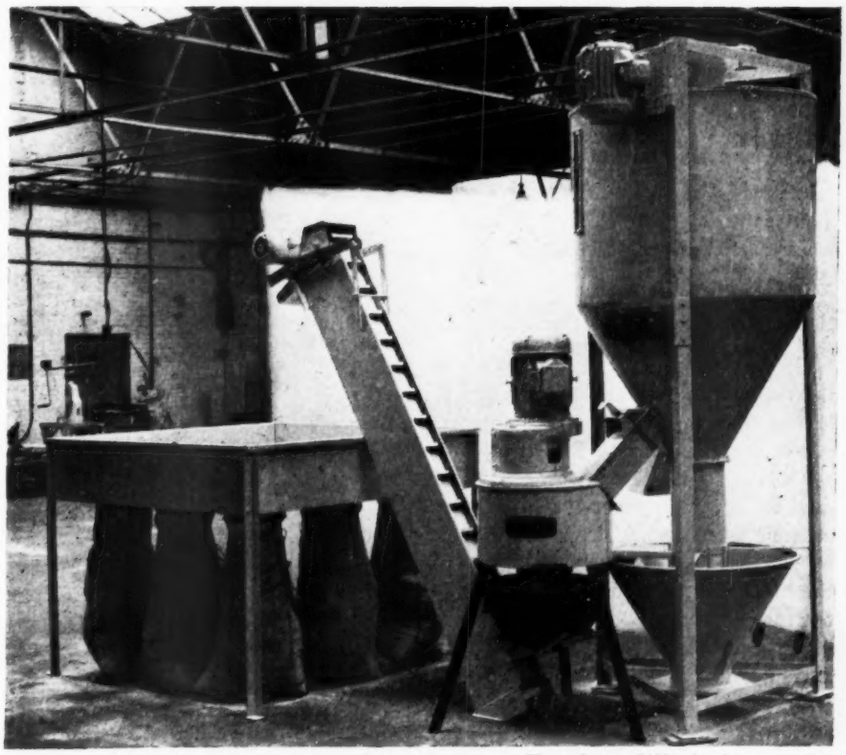
There was an interesting series of demonstrations of chain saws and hedgecutters on the stand of *Teles Smith Ltd.* Fast-cutting chain saws for 1-man and 2-man operation and powered either by electricity or petrol engine were seen doing the work of a gang, for these machines can be swivelled to any angle and they cut with ease and speed. The ' Tiger ' hedgecutter, which is available for three voltages, is particularly light and handy, and for high cutting or wide cutting they now have a lightweight extension handle.

With the increase in milling and mixing of stock feed on the farm considerable economies can be effected by the use of a cubing and pelleted feed. *Templewood Hawksley Ltd.* had arranged a complete unit consisting of a meal mixer, a Templewood ' Junior ' provender press, a cube elevator and a multiple hopper for bags. They also displayed a barn hay-drying unit, a grain drier, their tubular wheel extensions for tractors and their ingenious ' Multi-Culta ', a 4-purpose machine for the sugar-beet grower.

Implements on display by *W. A. Tyzack & Co. Ltd.* included an interesting assembly of cutting and wearing parts of agricultural implements and a representative range of their ' Horseman ' brand of agricultural tools.

V

Both Villiers and JAP engines were to be seen on the stand of the *Villiers Engineering Co. Ltd.* They ranged from a 4-h.p. 2-stroke to a 15-h.p.



Cubing and pelleting unit consisting of a meal mixer, a Templewood 'Junior' provender press, cube elevator and a multiple hopper

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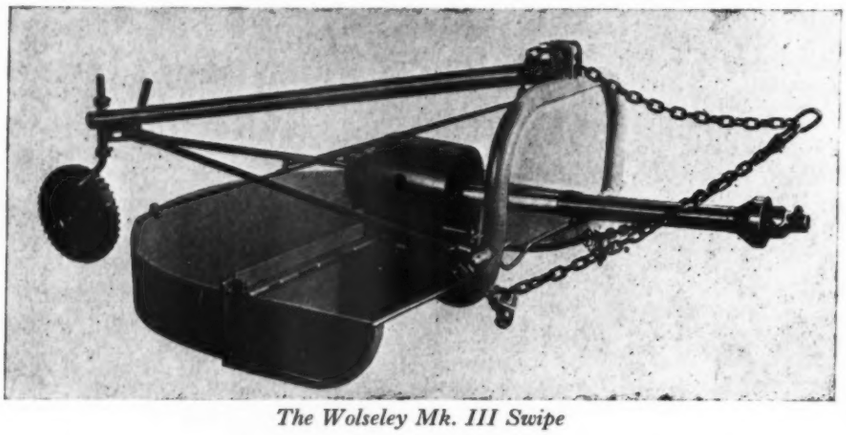
England

Teles 'Tiger' hedgecutter is a convenient tool. An extension handle can be used for broad or tall hedges

'Gehl' forage box. Other machines of importance to grassland farmers were the 'JF' forage harvester and a farmyard manure spreader. For dealing with the potato crop, there was the 'Cramer' automatic planter and the Wallace potato-lifting machines.

Weathershields Ltd. were showing new designs of their tractor cabs for the *Massey-Ferguson* '35' and '65' tractors. They are of tubular design and can both be fitted to their tractor in 15–20 min. No drilling of holes is necessary before fitting and they can be quickly removed by means of a quick-release system. The construction is so well reinforced that vibration and drumming have been reduced to a minimum.

Among the exhibits of *John Wilder*



The Wolseley Mk. III Swipe

4-stroke twin. These air-cooled petrol engines are used extensively in power farming and horticultural operations, providing power for mowers, scythes, cultivators, light tractors, sprayers, chain saws, elevators, balers, pumps, grain driers, lighting sets, light trucks etc.

W

Of particular interest on the *Innes Walker* stand, was their new turnip topper and tailer. This machine is p.t.-o. driven and is mounted on the 3-point linkage. The rotating topping disk is kept at the correct height by runners which travel over the turnip tops. The rear disk tails and digs up the turnip. The 'Clydebuilt Speedifit' tractor cab shown this year, has been given a new look by the provision of extra portholes, sliding windows and a large rear window in the curtain.

Seen for the first time on the stand of *John Wallace & Sons Ltd.* was a new machine for 'zero' grazing—the

Ltd. were included the smaller 'Sila-Masta 40', the 'Sila-masta 52', a 'Pitch-Pole' cultivator and the Wilder-Steed windproof loader. It was the 'Manners' hydraulic hitch, however, which particularly attracted attention. This device enables the tractor driver to hitch and unhitch trailers behind a forage harvester without him having to dismount, and the complete change-over operation can be made in 30 seconds. It is an automatic centralising device, which corrects for minor errors in steering, so that the drawbar ring is correctly located over the hydraulically-operated hook of the forage harvester.

Wolf Electric Tools can be described as the farmer's friend, as they enable him to do small running repairs to his agricultural machinery and equipment, and thus avoid the possibility of lost time during rush periods. Complete safety is ensured by the system of double insulation which is incorporated in their standard range of electric tools.

Wolseley Engineering Ltd. were presenting for the first time the Mk. III 'Swipe' and the heavy duty 'Super Swipe'. These machines have many improvements on the previous models and the 'Super Swipe' has been heavily reinforced to make it suitable for heavy scrub clearance work in tropical countries. Other interesting features were the 'Bell Fencer' working under water, the demonstrations of the 'Merrytiller' and an electric bird scarer—the 'Sting String'.

Wolf drill being used to remove a broken stud, while the tractor waits to take the implement back to work

Agricultural Chemicals

Big Bud Mite Control

Trials by the N.A.A.S. and by *Shell Chemical Co. Ltd.* over the past three years have shown that post-blossom application gives an excellent control of this mite as well as the capsid and blackcurrant leaf midge, whilst the pre-blossom application of 'Endrex 20' gives a very good control of aphids and partial control of big bud mite.

The application of endrin, post-blossom, to blackcurrants grown under contract for juice manufacture has been approved by the U.K. Ministry of Agriculture. The spray concentration should not exceed 0.04% endrin, which is provided by 1½ pints of 'Endrex 20' per 100 gal. of water; this application to be made as soon after flowering as possible. On blackcurrants for consumption in any form a late pre-blossom application is approved, whilst non-fruiting bushes and plantation stock may be sprayed at any time.

Experimental work has shown that no residues were detectable by chemical analysis, either on the ripe fruit as a result of the pre-blossom application or in the juice following the immediate post-blossom application. Therefore there are no limitations on the uses of the whole fruit or juice following treatment at the late grape stage or on the extracted juice following the post-flowering treatment. Small residues of endrin were found on the skins of the berries at harvest following the post-flowering treatment. In view of this the Ministry has recommended that pomace, or skins, from blackcurrant juice manufacture should not be used for human consumption.

Painting Rusty Surfaces

A new treatment for rusty metal surfaces has followed the discovery of agricultural implements buried in peat. Due to the tannin content of the peat in which they were buried, they were well preserved.

Formula 'E', the latest product of the *Plus-Gas Co. Ltd.*, gives the same protection. It is a tannating pre-treatment and its action on corroded metal is to combine with the iron oxides, so creating a corrosion-resisting film, which may then be painted over without any fear of the paint lifting or blistering later. It is claimed that the paint gives better coverage due to the smoother surface and there is also better adhesion.

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More Pyrethrum

The production of pyrethrum in Kenya is expected to increase as a result of steadily increasing world sales. Exports for the flowers and the extract from the flowers are estimated at £1,850,000 for the current sales period.

This natural insecticide is regaining its popularity since it has become known that insects are developing resistance to some synthetic insecticides. Pyrethrum also has the advantage of being harmless to animals and human beings.

For Potato Blight

A new *May & Baker* product, 'Tubosan', has the persistency of basic copper sulphate, as used in Bordeaux mixture, but couples this with the new fungicide ziram, which is practically non-toxic to the potato plant. The considerable reduction in the amount of copper sprayed on to the plants results in greatly improved plant tolerance.

'Tubosan' is a very finely-milled powder which readily forms a stable suspension in water, giving an even, persistent deposit. The combined fungicidal action of the two constituents, applied at a rate of 3 lb. per acre at volumes from 30 gal. per acre upwards, will, it is claimed, effectively prevent blight; if weather conditions necessitate it, the treatment may be repeated at intervals of two to three weeks.

Onion Maggot Control

Where onion maggots have developed resistance to many chlorinated compounds during the past few years and have become a major economic pest they can be readily controlled by 'Trithion'. Field tests, conducted by *Stauffer Chemical Co.* and by various experiment stations, have shown that the most effective method is furrow application of the pesticide when the seed is drilled in. Optimum control of onion maggot was obtained by the use of 20 lb. to 40 lb. of 5% 'Trithion', in granular form, per acre. Such treatments gave almost total control even in areas where maggot infestation was particularly severe. The material is safe to use on all varieties of onions and is equally effective on muck-manured as well as on fertiliser-treated soils.

Useful Insecticide

Standardised Disinfectants Co. are now supplying 'Malastan DP-25' in a convenient 3-lb. pack. It is a water-dispersible powder containing 25% malathion, which mixes easily with water and produces an exceptionally stable suspension.

In the agricultural field this insecticide is used for protecting ground crops, fruit trees and ornamental plants and is particularly effective against aphids, leaf hoppers, white flies, thrips, mealy bugs, scale insects, some caterpillars and the active stages of red spider mites.

The use of malathion for controlling pests attacking foodstuffs and other commodities in store is well established and this formulation may also be used for spraying the walls and other surfaces of stores, ships, railway wagons etc., as well as for spraying stacks of grain and foodstuffs and for application to the surface of standing grain.

Flour beetles, grain weevils and saw-toothed grain beetles are especially susceptible, whilst even the Khapra beetle, *Trogoderma granarium*, can be controlled with 'Malastan DP-25'.

The new product is also of interest to poultry breeders for use not only against red mite but also against Northern fowl pest – a difficult pest to control.

World Crop Reports

INTERNATIONAL REPORTS

Wheat

A warning that 'the world's grain economy is in a serious state of unbalance, which threatens to grow graver as each year passes' was given by Dr. Norman Wright, Deputy Director-General, FAO, when he opened the Fourth Session of the study group on grains in Rome in May. 'Carry-over stocks', he continued, 'have increased almost without interruption since 1952 and are now approaching 125 million tons, worth about 7½ billion dollars. It was clearly desirable that the bulk of the grain produced should be currently used rather than stored beyond an adequate reserve level. It was obviously necessary to increase consumption rather than to restrict output, but the problem was not merely one of increasing the consumption of wheat, but also that of other grains. One method was to increase direct human consumption in scarcity areas, and another was by indirect utilisation through the medium of livestock products'.

A new International Wheat Agreement has been agreed to by the delegates of nine exporting and 30 wheat-importing countries and came into effect on 1 August. It is a stronger and more realistic instrument than the agreement now concluded, but there is nothing in its terms which permits governments to take positive action towards a better balanced world wheat economy. On the contrary, individual governments can continue to pursue policies that will make the position even worse, according to a recent report appearing in *World Agriculture*.

The Committee on Commodity Problems, a 24-nation body of FAO, has received the report of its Washington Sub-Committee on Surplus Disposal, a standing group which acts as an inter-governmental forum for consultation between countries entering into surplus disposal transactions on concessional terms. The report includes proposals for a code of guiding principles worked out for the consideration of FAO's members. The chairman, Mr. C. F. Wilson, of Canada, pointed out that more time will be needed to enable governments to study them and their effect on surplus disposal operations.

REGIONAL REPORTS

Greece

The 1958–59 *cotton* crop in Greece is estimated at 289,000 bales, each 500 lb. gross, only slightly below last year's record crop of 290,000 bales. The area planted to cotton this season increased to 403,000 acres from 385,000 acres in 1957–58. However, drought late in the growing season resulted in somewhat lower yields in the non-irrigated areas.

Irrigated cotton acreage in Greece has expanded rapidly since 1945. About 57% of the 1958–59 crop was grown under irrigation, compared with 53% in 1957–58 and an average of only 35% during the years 1935–38.

Portugal

Preliminary forecasts indicate that 1958 dried *fig* production will be only 9,500 short tons, compared with 12,000 tons in 1957 and an average (1951–55) of 13,300 tons. A combination of cool weather and low rainfall is held responsible for the poor prospects.

Mid-July estimates still indicate a short 1958 *almond* crop of about 3,000 tons, shelled. This is considerably less than the 1957 crop of 6,200 tons and well below the average (1951-55) of 5,000 tons.

Ghana

Ghana's 1959 mid-crop of *cocoa* has been estimated at a record 15,000 long tons. Past production has ranged between 4,000 and 12,000 tons.

Mid-crops (spring and summer) will probably be even larger in the future. Cocoa farmers have planted large new areas in the Ashanti region. Most of the planting material is of Amazon types which produce throughout the year, whereas previously planted varieties bear one large main crop and a small mid-crop. Since 1955 Ghana's Department of Agriculture has issued 5.5 million Amazon seedlings and given out 2.3 million Amazon pods.

Since the beginning of the swollen shoot cut-out programme in 1948 about 80 million trees have been removed from approximately 133,000 acres. By the beginning of 1959 20,073 acres on 11,947 farms in former swollen shoot areas had been certified for replanting. Actual acreage replanted is estimated at twice this amount. Tree conditions at present are reported as very good except in those areas where capsids have not been controlled.

England and Wales

The weather during May was mainly sunny and rather warm. Rainfall was exceptionally low, although severe thunderstorms occurred in places. Widespread ground frosts occurred during the first week. Cold east winds reduced the temperatures in eastern districts during the second half of the month, but in other parts of the country, it was warm.

Autumn-sown *wheat*, *barley* and *oats* generally have made good growth. Spring-sown wheat, barley and oats were mostly satisfactory, although some later sown crops were patchy due to variable seedbed conditions. Mixed *corn* and *rye* on the whole were well forward. *Winter beans for stockfeeding* were mainly healthy and vigorous. *Spring beans* were satisfactory. *Peas for stockfeeding* looked well. Early *potatoes* generally were more forward than usual, frost damage being very slight. Lifting had begun in some areas. Second early and maincrop varieties looked promising, but later sown crops needed rain.

Germination of *sugar-beet* was good; on the whole crops were very forward and singling was almost complete in most areas; germination had been satisfactory and singling was in progress. Good progress was made with the sowing of *turnips* and *swedes*; earlier crops had germinated well, but growth was slow because of dry conditions. Early-sown kale was a good plant; germination of later crops had been slow and rain was needed; a considerable acreage remained to be sown.

Acknowledgment is made to *For. Crops Mark.* and to *Spec. Reg. Inform. Services* for much of the information contained in the above report.